THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 49. Thursday, September 28, 1933. No. 893.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (5 lines).

Contents.

	PAGE
Forthcoming Events	169
Employers and the Forty-Hour Week.—II	169
Visiting Cards	169
Hints for Crane Drivers	170
District Presidents.—No. 7	170
Random Shots	170
The Prague Conference	171
"Rapidor" Gate Saw	172
Studies on Solidification and Contraction and Their Relation to the Formation of Hot Tears in Steel Castings	173
Correspondence	174
Some Factors Leading to Greater Production from a Steel Furnace	175
Foundry Selling Practice	177
Catalogue Received	177
Works of Markham & Company, Limited, Chesterfield	178
Albion Works of Thos. W. Ward, Limited	179
French Foundry Competition Prize Winners	179
Scunthorpe Works of Thomas Firth & John Brown, Limited	180
Publications Received	180
This Week's News in Brief	181
Trade Talk	181
Personal	181
Raw Material Markets	182

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN, THE NATIONAL IRONFOUNDING EMPLOYERS' FEDERATION, THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk (*Telephone 332*).

Forthcoming Events.

OCTOBER 3.

Staffordshire Iron and Steel Institute:—First meeting of the Session in Birmingham. Presidential address by Harold E. Cookson. Mr. Cookson's address will deal with the development of rolling mills and rolls. It will also include the results of Mr. Cookson's interesting historical researches on the development of roll-founding in the Midlands. The address will be illustrated by a very excellent collection of lantern slides.

Sheffield Metallurgical Association:—"Age-hardening in Non-Ferrous Alloys," Paper by Dr. L. Aitchison.

OCTOBER 5.

Institute of Metals:—London Local Section. Address by S. L. Archbutt, Chairman.

Institute of Metals:—Meeting at Birmingham. Inaugural Lecture, "The X-Ray Analysis of Metals," by V. E. Pullin, C.B.E., B.A., B.Sc.

OCTOBER 9.

Institute of Metals:—Scottish Local Section. Display and demonstration at the Royal Technical College, arranged by Prof. Robert Hay, B.Sc., Ph.D., Chairman.

OCTOBER 10.

Institute of Metals:—Meeting at Swansea. Address by A. G. Ramsay, B.Sc., Ph.D., Chairman.

Institute of Metals:—North-East Coast Local Section. Exhibition of films.

OCTOBER 13.

Institute of Metals:—Sheffield Local Section. "Centrifugal Casting of Non-Ferrous Alloys," Paper by F. W. Rowe, B.Sc.

Institute of British Foundrymen.

OCTOBER 4.

Institute of British Foundrymen:—Lancashire Branch (Preston Section). Presidential address and lecture by Mr. W. West.

OCTOBER 7.

Institute of British Foundrymen:—Lancashire Branch Meeting at Manchester. "The Manufacture of the Mammoth Cunard Castings," Paper by Mr. F. Swift.

OCTOBER 10.

Institute of British Foundrymen:—Lancashire Branch (Burnley Section). "Foundry Essentials and Incidentals," Paper by Mr. F. Whitehouse.

Employers and the Forty-Hour Week.—II.

The reduction of working hours to forty per week for the same wages as are now paid for the full week, to which proposal we referred in our last issue, is similar in some respects to a proposal for increasing wages on the present week, and there is one aspect of this which is obtaining adherence in many quarters, and on which we should like to see authoritative industrial opinion expressed. It really arises out of the mechanisation of industry by virtue of which, for the application of the same amount of power, human energy and raw material, an increasing amount of product is obtained. The result of this in the past has been that the cost of manufacture of each unit of product falls, and, consequently, the selling price can be reduced. The demand, as a consequence, increases, and the mechanisation therefore justifies itself, because additional profit can be earned to cover the extra capital outlay involved. The point is, how far can this process be taken? What happens when a saturation point is reached, and the world is absorbing, for example, as many refrigerators as it requires for its normal purposes?

It is seriously suggested in many quarters that unless the wages of the consumer are increased it is impossible to increase indefinitely the output of the mechanised industry. Only through increased wages, so to speak, can a higher saturation point be established. The process can be extended indefinitely; the more wages are increased the more the demand can be increased, and hence the output. This is really a re-statement of the fact that industrial products are absorbed more and more as the standard of living increases. We had a familiar example in the States when the cheapness of the Ford automobile resulted in most of the workmen at the plant being in a position to run their own cars. The question of high wages ceases to become a matter settled as a result of negotiation, or as a question of social and economic requirements. It is seriously suggested that only by a deliberate policy of high wages can employers create the demand which it is the purpose of their plant to satisfy. Naturally, since a worker in an automobile plant cannot be expected to take part of his wages in the form of motor cars, the question would have to be settled on a national basis by the Government for the country as a whole. We confess that we have not yet seen any satisfactory answer to the argument; on the other hand, we have seen the policy of wage reduction set in motion by the economic crisis actually deepening that crisis by the reduction in the spending power of those whose daily demands provide the reason for the existence of the industrial machine. It affects not only the ordinary consumables required by the man in the street, but engineering plant as well. A citizen cannot step on to a tramcar without contributing, to however small an extent, to the demand for extensions and renewals of equipment, rolling-stock, etc.

Visiting Cards.

We are still entirely unconvinced by Mr. Eric N. Simon's arguments set out in his article "Foundry Selling Practice," published elsewhere in this issue. When we first took over the editorial direction of this JOURNAL, we made a collection of the visiting cards of foundry executives calling upon us. Most of them resembled those of the local builder and joiner. They were too large, contained many scrolls, and there was invariably the dotted line on which to write one's name. We wrote a leading article on the subject, and many firms sent us samples of their cards for criticism. From that time onwards there has been a distinct improvement, and we are now in a position to state that the visiting cards issued by the average foundry are definitely superior to those emanating from kindred industries.

Surely Mr. Simons must realise that, dignity apart, the listing of a large number of manufactures gives the impression that the issuing house is of the "jack of all trades and master of none" variety? This is an age of specialisation, and, if a firm has a number of departments, then it should have specialist representatives with their cards marked "Aluminium

die-castings department," or some other appropriate title. A buyer, on receiving a card with a formidable list of manufactures, looks at his watch and decides against devoting half a day to the discussion of a substantial portion of the material he buys.

We, too, have done both buying and selling, the latter on the Continent, and there we found the element of curiosity of invaluable use. We used our normal British visiting card, and were invariably received by the "man that mattered." So, too, a foreign visiting card presented to the average British firm will secure an interview. As Mr. Simons is an expert in publicity, he must know that many of the most successful advertising campaigns have been built up on the "snob" appeal, and a little of this was, and is, necessary for selling castings.

Hints for Crane Drivers.

(1) Keep the cab tidy.

(2) Take signals from one man only, and, before lifting, look for yourself to see that no one is in danger.

(3) Don't take your load over men at work. Go another way or get them to move.

(4) Only authorised repair men should be allowed to make adjustments.

(5) Don't tow trucks with the hoisting gear or push them with the jib.

(6) Don't operate the crane if anyone tries to ride the load or hook.

(7) Make sure the load indicator is in proper working order.

(8) Always try the load before starting to lift.

(9) Don't lift load too suddenly.

(10) An unauthorised person should not be allowed to work the crane or to be in the cab while the crane is working.

(11) Never leave the cab with a load suspended.

(12) Always leave your hook in a safe position so that no one will walk into it.

(13) Never lift loads on the skew. They will swing and may seriously injure someone.

(*For electric cranes only.*)

(14) Open the main switch when leaving the cab.

(15) Keep all the overhead girders, etc., free from loose tools and equipment which may fall and injure someone. Have a look round after repairs or adjustments.

(16) The limit stops are for emergencies. Test them regularly, but use the controls for stopping in the ordinary way.

(17) Before closing the main switch, make sure no one is in danger.

(18) When handling heavy loads test the brake by lifting the load a few inches and putting the controller in the "off" position.

(19) Ring your bell.

(*For locomotive cranes only.*)

(20) Do not travel unless you have received a signal from the authorised signalman.

(21) Don't swing your jib across another track unless it is free from traffic.

(22) Watch for overhead wires and bridges. Keep your jib low when travelling.

(23) When you move to a new place, take a good look round to locate obstructions to the movement of your jib.

(24) Don't allow unauthorised travelling on the crane truck.

["Industrial Safety Bulletin."]

District Presidents.—No. 7.

A native of Stockton-on-Tees, Mr. R. D. Welford served his apprenticeship at the firm of Messrs. Blair & Company, marine-engine builders, going through every department of the foundry.

He took advantage of the only means then available to enlarge his technical knowledge, attending classes in mechanical and geometrical drawing and steam and the steam engine held under the auspices of the Science and Art Department, gaining passes in all these subjects. Later he attended lectures on ironfounding and the first evening classes in metallurgy and chemistry at the Bradford Technical College, being certificated in these subjects in the examination in iron and steel manufacture.

He has also been a student of industrial economics under the Oxford University Extension Movement, passing with honours. He has held various positions as foreman since 1901,

Mr. R. D. Welford.

the most important in England being as head foreman for Messrs. Thornton & Crebbin, Limited, of Bradford, a firm renowned for their heavy castings and especially for cylinders and turbines, etc., for cruisers and battleships. This firm made most of the turbine castings for the first turbine battleship.

In 1909 Mr. Welford was appointed manager of the iron and brass foundries of La Sociadad Española de Construccion Naval, Ferrol, Spain, a Spanish company formed with the co-operation of Messrs. Armstrong, Brown & Vickers, and working under their technical direction and guarantee for the reconstruction of the Spanish Navy, the work undertaken ranging from torpedo boats to battleships.

Mr. Welford returned from Spain in September, 1925, and took up his residence in Bradford, living in semi-retirement, and was engaged only as lecturer and instructor in foundry practice at Leeds Technical College. He is at present in charge of the foundry of the Yorkshire Repetition Casting Company.

Mr. Welford is an old member of the Institute, joining the then British Foundrymen's Association in 1908. After his return to England he became an active member of the West Riding Branch. He has served on the council since 1928, was elected auditor in 1929, junior Vice-President in 1930, senior Vice-President in 1931, and has given Papers and addresses at the West Riding Branch and kindred societies on behalf of the Branch.

Random Shots.

A correspondent has suggested to "Marksman" that, in view of the remarkable theatrical talent possessed by some members of the foundry industry, a Foundrymen's Amateur Dramatic Society should be founded this autumn. Miss Nellie Snookers approves of the idea, and has gone so far as to write a short one-act play which she hopes will be included in the repertoire. It is called "The Inquest." The play is printed below. Inquiries about performance fees should be addressed to "Marksman," who is acting as Miss Snookers' literary agent.

* * *

The Inquest.

The scene is a foundry. A large waster casting occupies the centre of the stage. Grouped around it are a Moulder, Patternmaker, Metallurgist, Foreman and Salesman.

Moulder.—Gentlemen, I feel that I alone am responsible for this disaster. When I think of the careless way in which I made the mould, I cannot reproach myself too bitterly. The sand I used was too damp. I rammed it too hard. I did not trouble to finish off the face. I placed the runners and risers in the wrong positions; some I made too large, others too small. I used chills and sprigs and chaplets recklessly. The whole job was a disgrace to an apprentice in his first year.

Patternmaker.—I cannot allow my colleague to condemn himself so nobly, but so unjustly. Mine was the work that was really at fault. There in a beautifully-equipped pattern-shop, surrounded by the finest, seasoned timber, what did I do? I used green timber, full of knots and cracks. In marking out the pattern I made no allowance for taper, expansion, contraction or camber. I fixed the job up with two-inch wire nails and never used an ounce of varnish. The pattern was left out in the rain one night, and warped badly. That's why the casting proved to be a waster.

Metallurgist.—Let me confess that when I was working out the mixtures for the job, I was also working out my income-tax returns. I must have become somewhat muddled. Indeed, at the time, I thought that a carbon content of 8.6 per cent. was rather odd and that 19 per cent. of phosphorus was unusual. But I let it pass. What my old Professor would have said I dread to think.

Foreman.—What you lads have just said explains a lot. But I was in charge of the job, and should have noticed and gently pointed out your little errors. The fault was mine.

Salesman.—I can't agree with you. When I booked the order I knew it was for a type of casting that the foundry had never tackled before. If it hadn't been for the fact that I badly wanted the commission, I would not have accepted the order.

Enter Foundry Proprietor.

Proprietor.—We have all made mistakes, myself included. I should not have allowed the order to pass through the works. As it is, I'm sorry to say, I shall have to go into liquidation, and you poor fellows may lose your employment.

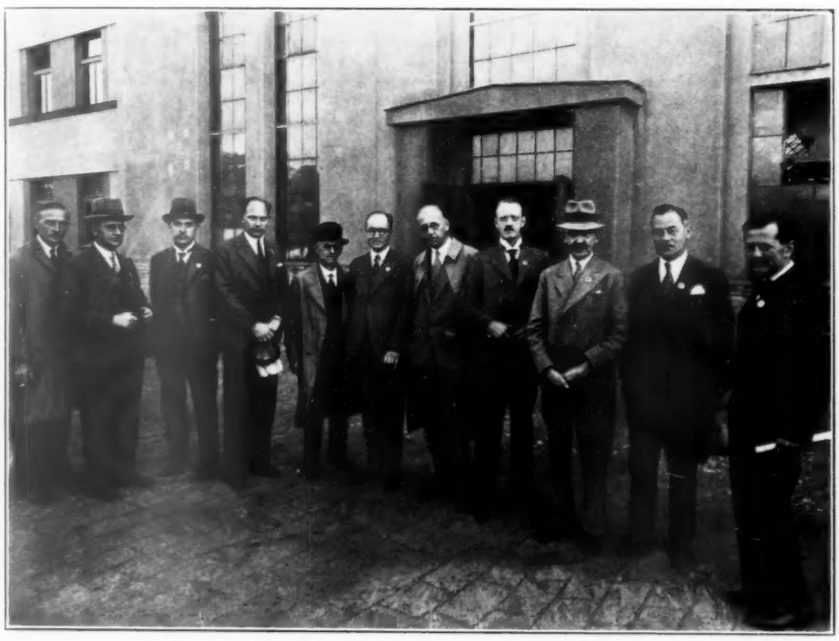
Enter the Customer, Dramatically.

Customer.—No, no! I have to say two things about that order I gave you; for one thing, I should not have made you cut your price so fine. Secondly, the job should have been welded, not cast. How sorry I am to have given you so much trouble! Will you, sir (addressing Proprietor), allow me to re-finance the company? Thank you very much. And now let us adjourn to the Blue Boar and forget our cares and sorrows. (*Exeunt and curtain.*)

Marksman.

The Prague Conference.

The British party, which consisted of Mr. and Mrs. John Cameron and Miss Russell (Mrs. Cameron's sister), Mr. V. C. Faulkner, Mr. T. Makemson, Mr. J. G. Pearce, Mr. R. H. Myers, Mr. D. H. Wood, Mr. and Mrs. Bigg, Mr. and Mrs. J. M. Primrose, Mr. and Mrs. Delport, Mr. John Shaw, Mr. J. Burgess, and Mr. E. Millington, left Victoria on Thursday, September 7. A moderate to rough crossing was experienced. Most of the party took advantage of the wait at Ostend to saunter along the front and take tea. Before dinner was served on the train, darkness had fallen, and the lovely Rhineland country was peacefully passed in the Schlaff wagon, except for a corpulent official's request for a statement of each person's present financial position. At Nuremberg the party entered Czech rolling-stock, which was to take them direct to Prague. Here the line passes through some of the most beautiful country in Europe. It is hilly, well wooded, with a winding river, and dotted all over with Christmas-card houses. At Cheb, the frontier station, the party made their first acquaintance with "hot-dogs" and pivo, that is, steaming hot sausages washed down with Pilsener beer



The British Party at the Works of the Ceskomoravska - Kolben - Danek.
Reading from left to right: Mr. R. H. Myers, Mr. J. M. Primrose, Mr. V. C. Faulkner, Mr. J. G. Pearce, Mr. E. Millington, Mr. T. Makemson, Mr. C. W. Bigg, Mr. Nilsen (Sweden), Mr. John Cameron, Mr. D. H. Wood and Dr. Malovsky (of the C.-K.-D. Company).

On arrival at Prague the party was met by Mr. Kraus, who thereafter made it his special duty to look after the British party. He soon became generally known as "Father Christmas," as he was kindness personified.

The Conference opened at the Municipal Library at Prague by speeches of welcome from Prof. Pisek, the President of the Czech Foundrymen's Association, and Mr. J. Dostalek, Minister of Public Works. After a reply by Mr. Maas Geesteranus, the President of the International Committee of Foundry Technical Associations, for the whole of the visitors, Mr. B. Volesky, a Vice-President of the Czech Association, also added a few words of welcome. Then came the replies from all the various foreign associations. Mr. V. C. Faulkner replied for the British, Mr. V. Delport for the Americans, Mr. Magdelénat for the French, Dr. Guido Vanzetti for the Italians, and Mr. Léonard for the Belgians.

Mr. Faulkner, in his speech, said, after thanking the hosts for their kind welcome, how much the British regretted the absence of their President, Mr. C. E. Williams. He recalled how, in 1922, international co-operation in foundry technical matters was initiated by the late Mr. Oliver Stubbs, the late Mr. Cole Estep, Col. Cheesewright, Mr. Ronceray and himself, and how in 1926 organised meetings were established by the creation of an international committee through the endeavour of Mr. Paul Ropsy, its first President. Time would not permit of a recital of all those prominent individuals who had done so much to make possible such meetings as the one being held that day, but the names of Dr. Werner, the late Signor Vanzetti, Mr. Cameron, Mr. Damour, and Dr. Geilenkirchen were outstanding.

The German speech took on rather a political aspect, which undoubtedly was not appreciated by the bulk of the speaker's nationals, as, obviously, there is no room for politics in international scientific gatherings.

Luncheon was served at the Engineers' Club, and afterwards a visit was made to the Applied Art Museum, where a really excellent exhibit of art castings was staged. The party was impressed by the fact that modern tendencies in art lend themselves better to expression as iron castings than does the more classical conception.

At about 4 o'clock the party adjourned to the Town Hall for a reception by the Lord Mayor of Prague. Here light refreshments were served and were much appreciated. The furnishings and decorations were much admired, especially the craftsmanship shown in inlay and veneer work.

The International Committee.

On Sunday morning Mr. Kain's Paper was presented before quite a small audience, as four sessions were being held simultaneously, as well as Test-Bar and International Committees. At the latter meeting, Prof. Pisek was elected President for the coming year and Mr. Gierdziejewski, of Poland, Vice-President. The Hungarian Foundrymen's Association was admitted to membership, while the Spanish, who hitherto have had representation through the French, also intend organising an association and applying for membership. This will mean that no less than eleven nations will be represented on the Committee. An invitation was extended by Mr. V. Delport, on behalf of the American Foundrymen's Association, to hold a meeting in that country in the autumn of next year. Mr. Faulkner promised that he would make representation to the Institute of British Foundrymen to extend the work done many years ago by Dr. Longmuir and Dr. Swinden to rationalise foundry nomenclature by extended definitions of technical terms. The meeting closed with a vote of thanks to the chairman, Mr. Maas Geesteranus, for presiding.

The Prague Sample Fair.

We spent Sunday afternoon visiting the Prague Sample Fair. This is housed in a multi-storeyed building of American aspect, built around a quadrangle carpeted with flowers. We were not impressed with the engineering exhibits but were interested in the stove-grates, and domestic appliances. It was quite obvious that the majority of these are quite different from those made for the British market, both home and export. The stove-grates are cumbersome and extremely decorative, washing appliances were of lighter and cheaper construction than is customary here, whilst more use is made of galvanised iron. Radiators were shown made from welded-steel pressings instead of the usual cast-iron segments. No foundry equipment beyond a sectioned ladle demonstrating its method of lining with firebricks was noticed by us. The arrangements for the reception of the foreign visitors were not too good, as only German and Czech literature was apparently available.

C.-K.-D.

It is not intended to describe the various works visited during the tour, as they have previously been dealt with by Prof. Pisek, and will form the subject of a lecture to be given in London by Mr. T. Makemson in the near future. Thus the following notes are generalities designed to familiarise our readers with the nature of the work being done and the social side of the programme undertaken. The first works visited was the Ceskomoravska-Kolben-Danek, which is situated on the outskirts of Prague. As was customary throughout the programme, an early start was made, the rendezvous being at 8 o'clock in the centre of the city. On arrival at the works the nationalities were segregated, and, generally speaking, the Swedes, Dutch and Dr. Vansetti formed part of the English-speaking section. The party was particularly fortunate in having Dr. Malovsky as guide, as not only does he speak excellent English, but was also thoroughly conversant with every phase of manufacture in this very considerable establishment. The first department inspected was the steel foundry, where acid open-hearth furnaces were used. This activity was reflected in the malleable foundry, as the annealing pots were steel castings. Copper steel was being used with success. The most interesting department was that devoted to the manufacture of magnesium castings. Parenthetically, we do wish that some inventive genius would find a material to replace the sulphur which is mixed with the sand, as it has a most unpleasant reaction on tender throats. Another "star" department is the pattern shop, in which we were pleased to note a number of Wadkin machines. The waste from this department is burnt, and the heat generated is used to season the timber and perform other useful purposes. Few repasts were better enjoyed than the buffet luncheon served in the light-castings stores. Here many "hot dogs" and much "vin du pays" were consumed. Thus few did justice to the proper luncheon served at the railway station restaurant prior to embarking on a special train which was to carry the party to

Moravská-Ostrava. A few of the British visitors spent the morning at Poldi—a crucible-steel works—instead of at Cesko-Moravska-Kolben-Danek.

At Ostrava.

This large town is situated a few miles from the Polish frontier and shares a common coal-field. On the Polish side there are the towns of Gleiwitz and Kattowitz. It was about eleven o'clock when the party arrived, and as they had to be on parade at eight o'clock the majority deferred exploring the town until next day. Two alternative visits were offered, one to Vitkovice (Witkowitz) and the other to Trinec. Most of the British party chose the former. It is a vast establishment owning coal pits, coke ovens, blast furnaces, grey-iron, pipe and steel foundries, steelworks, rolling mills and brick-works. Trade was obviously bad and employment at a low ebb. The only department which was busy was that devoted to the manufacture of locust fencing for the Argentine. This is a portion of the same contract which figured so largely in the British Press a few weeks ago. The pipe foundry uses the Ardelt process, but several of the pits were out of commission. The steelworks, too, were only operating at about 10 to 15 per cent. capacity. The morning's visit was fairly strenuous and the excellent luncheon offered by the management came as a welcome relief. In the afternoon the two groups joined together to inspect various local coke-oven plants.

Zlin.

A change was made in the "signing on" time on Tuesday, September 12, it being advanced by half an hour to 7.30. The party arrived at Zlin at about half-past ten and spent the whole of the day wandering around the gigantic boot factory of Bata. The time of departure from this town had been altered from 4 p.m. to 5.30, with the result that dinner was taken at Brno at about 10 p.m. instead of eight o'clock. The British party was without Mr. Cameron, Mr. Makemson and Mr. Delport, who, together with Mr. Maas Geesteranus, Prof. Pisek, Mr. Magdelénat and Mr. Léonard, had accepted an invitation to visit President Masaryk at his country villa somewhere near Bratislavia.

Brno.

In the beautiful city of Brno the visitors had the choice of two double visits. The first was to an engineering and carriage works and a smallish grey-iron and malleable foundry, Uxo Brothers, and the second to an electrical engineering works and another grey-iron, steel and malleable foundry of modest dimensions (Ignac Storek). The electrical engineering concern normally employs about 4,000 men, but to-day only 400 are engaged. We were told that similar conditions were ruled at the wagon works. The Storek concern was much more interesting, as not only were they much better employed, but also their lines of manufacture were of exceptional interest. They have an agreement with Firths, of Sheffield, and manufacture under licence many types of special steel. They have installed a Sheffield type of crucible furnace, and make their own crucibles. For some of the alloys, they import direct from England and just remelt. In the malleable shops was found a new use for old railway tyres as annealing boxes. Unquestionably the Storek concern makes excellent castings in both steel and malleable. After luncheon at the Zemsky Dum Restaurant, an establishment equal to the best of anything to be found in British provincial cities for size, decoration or culinary excellence, we entered our special train at 3 o'clock for the seven and a-half hours' journey to Plzen (Pilsen).

Pilsen.

All were present at the 7.30 a.m. roll call for the visit to Skoda, which, as the *pièce de résistance*, was left to the last day. Beyond asserting that this firm's fine reputation for steel castings is due in no small measure to a happy marriage of scientific control and standardisation, we will leave the detailed description to Mr. Makemson. After inspecting what must surely be one of the best equipped research laboratories in Europe, the party was joined by the ladies for a visit to the Citizen's Brewery. It is called the Citizen's Brewery because its charter limits its shareholding membership to freeholders of Pilsen, who also possess a brewery licence. The beer carries 3.6 per cent. alcohol and can thus be consumed in large quantities without danger to one's driving licence. The directors entertained the visitors to luncheon, and as no water was available even life-long abstainers felt that out of courtesy they must join in with the rest.

Friday afternoon was the first time the party had a little free time, and most used it to catch up with their mail and devour the four English newspapers that were available.

On Saturday, there was a visit to the Western Bohemian Kaolin & Refractory Works, but we are sorry to report that only Mr. Myers took advantage of the invitation. The rest, we are afraid, thought too much of the *semaine anglaise* and went off on a motor-coach trip to Carlsbad and Marienbad. Doctor's orders apart, the latter can be recommended as being superior from the point of view of sheer beauty.

The Closing Banquet.

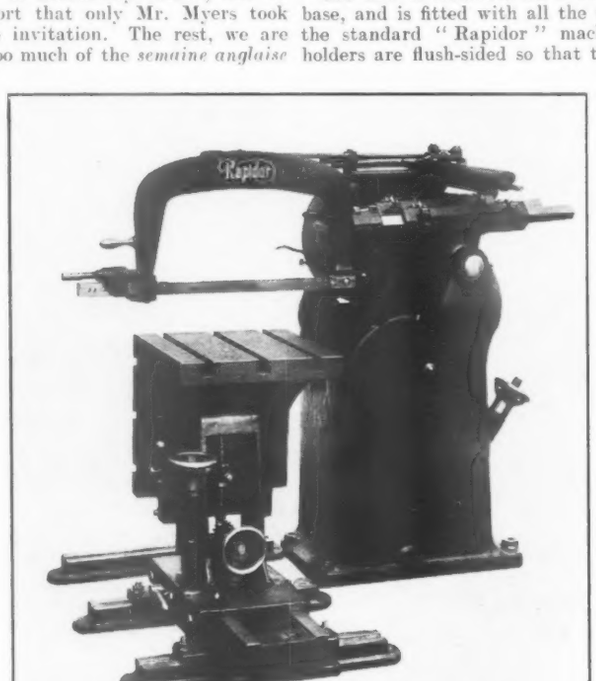
The banqueting hall was delightfully decorated with the flags of all nations, while centrally positioned on the centre wing was a very cheery little galleon. It was not, but ought to have been, christened the "Lancastria." Delightful music was rendered by a military band and a male-voice choir. The speeches, being made in Czech, French and several other languages, were candidly boring. One of the ideas in having an international foundrymen's President was to let him speak for all the nations, and Mr. Geesteranus was well fitted to carry out such a task. Thus, coffee was served at midnight and afterwards dancing went on until the early hours of the morning.

We would like to take this opportunity of expressing the thanks of the British party to Prof. Pisek, Mr. Kraus and Mr. Malovsky for their continued personal attention to the party's smallest wishes, and to the directorates of the various works for their kindness in opening up their establishments for inspection and for their lavish hospitality. Congratulations are also due to the excellence of the organisation throughout. There is little to report of the return journey. The fine weather which had favoured us throughout continued right across the Channel to London.

"Rapidor" Gate Saw.

The "Rapidor" gate-sawing machine illustrated herewith is the latest addition to the range of "Rapidor" heavy-duty sawing machines. The saw itself follows the standard design of the "Rapidor" type of machine, and in this instance is made of 8 in. by 8 in. capacity, and fitted with three-speed-gear belt drive. The machine can be supplied also with single-speed drive or can be arranged for motor drive as desired, either single- or three-speed.

The saw is mounted on a substantial column base, and is fitted with all the usual features of the standard "Rapidor" machines. The saw-holders are flush-sided so that the blade can cut the gate as nearly as possible flush with the casting. In order to render the machine as adaptable as possible and to enable it to cope with large and awkwardly-shaped castings, it is made in two units, and the work support is in the form of a table mounted on slide rails and fitted with horizontal traverse and vertical adjustment also.



"Rapidor" Gate Saw.

In the example shown, the table measures 15 in. by 15 in. by 12 in. and is T-slotted on top and side for ⅝-in. bolts. A vertical adjustment of 8 in. is obtained by a bevel screw support, and horizontal traverse of 12 in. by rack and pinion. The table can be locked horizontally and vertically in any position and is bolted on two slide rails, a third slide rail being provided so that the table can be moved from the left-hand side of the machine to the right as desired.

The overall dimensions of the machine are: Height 3 ft. 9 in., width 3 ft., length 4 ft. 6 in. Castings can be sawn up to 3 ft. 4 in. high from the floor, and if a pit is dug at the side of the machine, taller or larger diameter castings can be dealt with. For specially difficult work the machine can be supplied with a table unit having universal adjustment.

This equipment is made by Messrs. Edward G. Herbert, Limited, Atlas Works, Chapel Street, Levenshulme, Manchester.

Studies on Solidification and Contraction and Their Relation to the Formation of Hot Tears in Steel Castings.

By Charles W. Briggs and Roy A. Gezelius, Washington, D.C.

(*Continued from page* 160.)

It is perhaps well known that green-sand moulds have less mould resistance than dry-sand moulds for the reason that dry-sand mould will have a greater hardness and the sand a greater compression strength. Castings that crack in dry sand may not crack at all in green sand. Cores are especially responsible for mould resistance. The core irons and reinforcing bars offer a resistance that is difficult to overcome. Later on in this article, methods will be considered whereby mould resistance can be materially decreased and in many cases eliminated.

The metal itself can set up contraction stresses of such a nature that cracking takes place. These stresses are the direct result of the manner in which the casting solidifies. The concentration of these stresses usually takes place at a rapid change in section of the casting where the thinner portion is solidified and the heavier portion partly fluid. The thinner portion would be contracting and the concentration of these stresses will be at the weakest point, which is the junction of the thin section with the thick section.

In many cases the stresses are concentrated by the solidifying metal and, as the mould resistance prevents contraction of the casting, hot tears are formed. It has been claimed that the concentration of these stresses is caused by uncontrolled directional solidification. If no thought has been given to the rates of solidification of various sections of the casting, the metal will solidify in such a heterogeneous manner that a thin section which has totally solidified will pull away from the thicker section which is in the critical range for crack formation.

Pipes or Cavities.

The authors consider that pipes and small cavities are factors in the formation of hot tears as they become centres of stress concentration. These views are not held by everyone. K. Singer[13] is of the opinion that cracking is not associated with the formation of pipes and that the crack forms earlier than the pipe. It is hard to believe that this statement tells the entire story about the formation of cracks. It is quite possible that cracks do occur while the casting is solidifying, but it is equally possible that cracking may occur after solidification is complete and while the casting is at high temperatures—for example, between 1,300 deg. C and the solidifying temperature.

Pipes and cavities form at the last point of solidification of a section, and thus are inherently the weakest points of the casting. It is well known that all types of cavities are points of stress centralisation, and thus the two factors of metal weakness and stress concentration produce hot-tear cracks. Theorising is all very well, but are hot tears and cavities found to exist simultaneously in practice? Fig. 7 shows one of the numerous cases the authors have found in studying defective castings. It shows a section of a casting that has been machined. It will be noticed that the cavity is in the centre of a change of casting section, where an abrupt change is made to a much thicker section. The cracks are clearly seen leading out of the cavity.

It has already been pointed out that abrupt changes in section are centres for stress centralisation, and that if there is a lack of controlled directional cooling, pipes will form which become the point of stress application. The result is, as is shown in the photograph, hot-tear cracks. The photograph, in conjunction with radiographs, also offers the suggestions that cracking takes place after solidification, or perhaps during the pasty stage of solidification, as otherwise the crack would not have been found penetrating the metal surrounding the cavity, since this portion of the crack would then have been filled by the last solidifying metal. It frequently occurs that an external tear is indicative of the presence of an enclosed pipe or shrinkage cavity, particularly at the radiused junction of a flange with a body.

Physical Properties of the Steel.

The information that is available on the physical properties of steel at temperatures closely approaching the solidification temperature is nothing more than theory or supposition

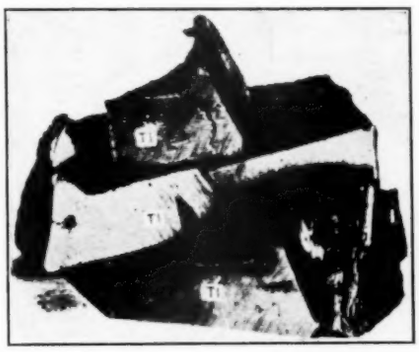


FIG. 7.—HOT TEAR EXTENDING FROM A CAVITY IN CAST-STEEL SECTION.

resulting from an attempted interpretation of conditions that have been found by experience to exist. The greatest difficulty in this regard is that there are so many contradictory opinions that it must be admitted that knowledge is very scanty. It can be seen that the formation of hot tears depends somewhat on the physical properties of the metal. It is true that the strength at these high temperatures is quite low—so low, in fact, that a slight change may increase the strength by 50 per cent., 100 per cent., or more.

Then, again, how important is ductility at these temperatures? Is it not possible that the metal elongates under stress at these high temperatures, and, if so, would it be possible to increase the ductility? These are merely a few of the large number of questions that need answering. On this question of physical properties for resisting cracking there are two paramount and somewhat contradictory ideas in vogue. It is held by certain practical foundrymen that the higher the carbon (preferably 0.35-0.40 per cent.) the greater the strength of the steel, and therefore the casting is more able to withstand hot-tear formation. Another group holds that the lower the carbon (preferably 0.20-0.25 per cent.) the greater ductility of the steel at the cracking temperature, and the casting is then able to withstand hot-tear formation due to stretching or elongation. Which of these views is correct, or are they both correct? Perhaps the carbon content is only indirectly responsible for the effects that are noticed. Carbon is not the only outstanding example of the use of alloying elements to resist cracking.

It is claimed that manganese adds strength to the metal at temperatures just below its solidifying range, and that nickel toughens the metal so that it will elongate instead of fracturing. Perhaps there are other elements that may be alloyed that would increase the strength or ductility more than carbon, nickel or manganese. Then, too, it is well to point out that carbon, nickel, manganese, or any other alloying element may have no appreciable effect at all on the strength or ductility of cast steel in the temperature regions just below the solidification range. These features are important and should be studied with the idea of obtaining quantitative information. Attention should also be called to the important rôle that oxygen and oxides may play in controlling the physical properties at these high temperatures.

For the sake of clarity it is pointed out that this discussion of alloying elements would apply only to solidified steel. It is rather difficult to understand how alloying elements could bequeath strength or ductility properties to steel in the mushy state of the solidification range. As cracks do exist at this stage, other plans for their elimination must be formulated.

The Naval Research Laboratory at present has set up a research of this nature, and, although the problem is a tedious one, it is expected that in the near future information on the strength of steel as-cast at high temperature will become available.

Before leaving the subject of cracking in completely solidified steel, it should be pointed out that the temperature at which the hot tears take place will depend on the strength of the metal and the amount of stress on the casting. The strength of the metal increases very gradually from no strength at all just prior to solidification to what is still a very low figure at 1,300 deg. C. Rosenhain has claimed that mild steel of the type used in steel castings has, in the neighbourhood of 1,100 deg. C., a strength of a little over 2,000 lbs. per sq. in., while in the neighbourhood of 1,300 deg. C. it is less than 800 lbs. per sq. in.

The amount of stress on the casting is that resulting from hindered contraction. Just prior to solidification of the casting the stress would be zero, and as the temperature drops, the stress becomes greater. No data are available as to the comparable rates of increase in strength or stress due to restricted contraction at high temperatures. It has been observed, however, that in the neighbourhood of 1,300 deg. C. (2,372 deg. Fah.) the stresses developed by resisted contraction are sufficient to crack the casting. Below this temperature the strength of the steel increases more rapidly, and is therefore sufficient to withstand the stresses that are developed by hindered contraction.

Fluidity.

French foundrymen have emphasised the importance of obtaining fluidity in cast steel, as in their opinion the smaller percentage of defects will be found in castings poured with a more fluid steel. There are points in favour of such a supposition. In the first place, the greater fluidity allows for better controlled directional solidification and the possibility of filling up cracks. If a crack should form in a portion of the casting already solidified and the crack extends to liquid metal, then the greater the fluidity of the steel, the more opportunity there is for the crack to become completely filled.

It is quite possible that fluidity is the controlling factor rather than strength, and that the higher carbon steels (0.35 per cent.) are not so susceptible to cracking. Singer makes the statement: "The higher carbon steels remain fluid in the mould for a longer time and pieces cast from these steels are, as is known, less liable to crack." Singer stresses the fact that fluidity is responsible for non-cracking. However, he has forgotten that the cracking may take place after

the casting has completely solidified, but while it is still at a very high temperature. Fluidity certainly would have no influence on such conditions.

Types of Hot-Tear Cracks.

In the preceding discussion the factors that are deemed most important in the formation, or in restricting the formation, of hot tears have been listed. It is now proposed to examine the methods of formation of hot tears. It is the authors' opinion that there are two types of hot-tear cracks, as follow:—(*a*) The internal hot tear that develops during the solidification of the casting, and is caused by a lack of controlled directional solidification; and (*b*) the external hot tear that develops after solidification is complete, and is caused by stresses due to mould resistance. These cracks occur at temperatures slightly below the solidification temperature.

Fig. 8.—Gamma Ray Radiograph of Typical Internal Hot Tear.

The Internal Hot Tear.

Internal hot tears are of a decidedly ragged nature with numerous branches. They have no definite line of continuity and usually exist in groups. These tears seldom terminate at the surface; in fact, most of them do not. When they do appear at the surface, they are usually very small and difficult to locate. Upon exploring them downward, they will be found to branch out and become more pronounced. The radiograph of Fig. 8 shows a type of internal hot tear.

It has been said that the cause of the formation of these cracks can be traced directly to a lack of controlled directional solidification. It can readily be seen that the tearing is caused not only by the great differences of temperature in the casting, but that it also depends on the nature of the transition from the hottest to the coldest parts of the casting. A solidified section will pull away from a larger semi-solidified section if the transition between the sections is abrupt. However, if the transition is more gradual, the contraction forces are not so concentrated because solidification proceeds in a more controlled directional manner.

A lack of controlled directional solidification is also responsible for the lack of metal, and a cavity is the result. This cavity may form as a crack instead of a pipe in certain heavy sections, since the contraction of the metal toward the solidifying centres is sufficient to create a stress that tears the casting. These tears occur and proceed from the inner solidifying face outward toward the surface, since the forces of contraction concentrated on the section will be sufficient to tear the weaker, less rigid portion of metal. Once the tear has started, it easily penetrates the stronger metal. This hypothesis can be correlated with the observed facts, as it is found that in the interior of the casting the tears are quite large, while they appear only as small cracks at the surface.

Incrustations and noticeable risings on the surface of castings have led to the opinion that crevices have formed in the steel casting which afterwards have been filled. Such incrustations of the surface have been found in castings at places where there is a danger of cracking, usually without any cracks in the surface being observed. Singer and Bennek[18] have very logically explained these observed conditions. It is their opinion that as the walls of the mould were perfectly smooth at these places before the piece was cast, the incrustation must have arisen after the shaping of the casting, presumably because the solidified outer skin of the casting was ruptured at this place, a crack being also produced in the wall of the mould adjacent and adhering to this outer skin, in the same direction as the crack in the casting. The fluid steel making its way into the crevice soon after the rupturing of the outer skin also filled the crevice in the mould and thus led to the incrustation.

The filling up of cracks is a subject on which there is little information, although the idea is not a novel one. The principles involved are very similar to conditions of rock formation and the actions of intrusives, but certain favourable conditions must prevail. In the first place, the crack must open up from the inner solidifying wall of the casting and proceed outward to the surface. The steel section must be thick enough to allow for gradual solidification toward the centre of the section, and the steel must be of such a degree of fluidity that it will be able to flow through the crack to the surface of the casting. Of course, the actual distance through which it flows may be very short, as the skin of the casting may be only a few millimetres thick when the crack takes place. The difficulty becomes more pronounced as the solidification proceeds.

It is the authors' opinion that the filling up of cracks is the exceptional rather than the usual case, for two reasons. The contraction stresses are not usually sufficient to crack the skin at the first phase of solidification when the liquid metal does not have to proceed far to fill them, and the fluidity of the steel is so low that the liquid steel could not traverse the crack when the stress became sufficient to produce a hot tear. The latter statement is based on the typical American practice of pouring heavy castings at as low a temperature as possible.

To proceed with the supposition that cracks may be occasionally filled, it is suggested by Singer and Bennek that the cracks may be filled either by the general solidifying metal or by the mother liquor. In the first case the metal is forced into the crack under the pressure of the fluid column of the pouring gate, and the crack as filled will not differ in chemical composition from the material surrounding it. In the second case the impure, later-solidifying mother liquor is forced into the crack under the pressure of the contracting crust, and the crack in filling will have a higher carbon, phosphorus and sulphur content than the material adjacent to it.

Furthermore, they uphold their contention by exhibiting specimens of filled cracks which show segregations and, in places, a plainly visible transcrystallisation of the filling metal in a direction perpendicular to the walls of the crack. If a crack can be filled with mother liquor in the manner described, then a filling with liquid reservoir metal is equally conceivable. It is rather difficult, however, to produce proof of this fact, since the material of the fractured outer skin and that filling up the crack usually shows no noteworthy differences in chemical composition. The time at which the cracks occur in the first-formed skin of a casting depends on the forces of contraction arising in the piece as it cools, hence, on the form of the piece. If the form is such that cracks occur in the outer skin while it is still thin, then these cracks may have an opportunity to be filled from the liquid reservoir, providing the steel is fluid enough.

(To be concluded.)

[18] Singer, K., and Bennek, H., "Ein Beitrag zur Warmribbildung an Stahlgubstucken," Stahl und Eisen, 1931, p. 61.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Iron Crucible Pots.

To the Editor of The Foundry Trade Journal.

Sir,—I shall esteem it a favour if you would kindly give us advice on the following problem:—

Crucibles are required 10½ in., inside dia.; 26 in. deep, inside; ½-in. metal round dia.; 1-in. metal at bottom; open at top, with metal thickened to 1 in. outside, this forming rim 1 in. down. When filled with the material required to be burnt, a loose cover is put on, which is also cast iron, and it is placed in the furnace. While red hot the cover is removed and the contents ejected by upending the crucible. If scale drops into the material during this operation its value is greatly reduced.

Our trouble has been caused by the scaling of the crucibles, on the outside, which drops into the material and also that cracks soon develop after about 20 heats. The pig used is hematite No. 1 mixed with good machine scrap. Various mixtures have been tried, but without success. The pig has been tried from about 40 per cent. down to about 20 per cent.

If any readers can offer suggestions they will be gratefully received.—Yours, etc.,

Puzzled.

Durban,
South Africa.
August 29.

Some Factors Leading to Greater Production from a Steel Furnace.*

By Arthur Robinson (Scunthorpe).

(Slightly Abridged.)

It is very important under to-day's conditions of intense competition in the steel trade, that, subject to the ability to dispose of the output, every unit should be used to its utmost capacity in order to keep down the cost of production. In the following Paper, the speeding-up of the working of the steel furnace will be discussed, and particulars given of the results obtained with the tilting furnaces of the Appleby Iron Company, Limited (subsidiary of the United Steel Company, Limited), Scunthorpe, Lincolnshire, to whom the author is indebted for permission to publish these results.

The factors which control the rapidity of working, with its attending fuel economy, are: (1) Furnace design; fettling and repairing practice; heating control; (2) charging and casting facilities; (3) quality of raw materials and mechanical condition thereof; (4) process and practice; chemical control; (5) staff.

Furnace Design: Fettling and Repairing Practice; Heating Control.

In rebuilding a steel furnace after a run, great care must be taken that each part will be equally strong and last an equal time. The continual interference with the working of a furnace by doing minor repairs to door arches, gas-port ends, back and front linings and blocks not only takes time that could be more usefully employed, but by cooling down the furnace, delays the working and gradually ruins the brickwork on other parts—causing further delays.

The life of the furnace roof and linings depends upon the ease with which the original lines of the block can be kept and on the proper control of the furnace draft—given the hypothesis that these lines are correct to commence the run. Any damage done by the deflection of the gases due to improper charging will be considered under another head. There is no reason why the life of the linings should be less than that of the roof or blocks.

The use of a few cooling water pipes across the nose of the block will keep the shape and pitch of the gas and air ports substantially constant, and water-cooled doors and arch plates protect the arches and jambs from rough usage by the charger, keep the arches and door linings much cooler and also keep the door openings much tighter against leakages of gas round the arches, and there is consequently much less spalling. By fettling the linings and door jambs each time after charging with a little magnesite/chrome-ore paste (which protects silica brick very well), the premature failure of the linings and door jambs is prevented. To do this successfully it is necessary that the linings should have some slope. The fettling of gas-port back stoppings is a continuous and expensive item on many furnaces, and this again can be almost entirely prevented by a few water-cooled pipes built into the wall.

For large furnaces the fettling time can be cut down considerably by the use of the Blaw Knox fettling machine, which makes a good job of the back bank and fettles a considerable distance up the back lining. A sound job can be done with its aid in 10 to 15 mins., including fettling the front bank by hand. The time taken when fettling wholly by hand was ¾ hr. as a minimum. Careful attention should always be given to the proper fettling of the end banks under the gas ports, as very little hills or hollows in this position can cause a large deflection to the flame.

The water required for cooling purposes on a 250- to 300-ton tilting furnace is as follows:—(*a*) Cooling pipes for gas port nose and back stopping, approx. 10 galls. per min. each, or approx. 250 galls. per furnace; (*b*) water-cooled door arches (average of run), approx. 25 galls. per min. each; (*c*) water-cooled doors, 6 galls. per min. each.

The furnace life without any repairs except to door arches and fettling is 35,000 to 43,000 tons. The gas-port back stoppings require less than one small repair per run on the average, and the number of door arches repaired does not average more than one per week for three furnaces. The burnt dolomite used amounts to 0.45 cwt. per ton of ingots. Bottom troubles and consequent delays are almost entirely avoided on these furnaces by the practice of not emptying from the commencement of a run to the end, unless a holiday week intervenes.

The best design of the chequer chambers and fillings is a matter which is receiving considerable attention at the present time. Besides the more usual fillings of square bricks, there are many forms of special chequer fillings, but the matter has not been solved owing to the contradictory nature of the requirements for a perfect chequer setting. Heating by radiation requires large openings, which offer little resistance to the gas flow and do not choke up with dust so easily. The waste gases tend to be hotter.

Heating by convection requires high velocity and small openings, twisted or chequered in order to give turbulence to the gases to wipe off the insulating film of gas round the brick. These chequers have a greater resistance, requiring more chimney draft, and easily choke up. Thin-walled, small-holed special chequer fillings have disadvantages in that there is a much greater resistance to the flow of gases, a quick choking-up with dust, and a tendency to overheating and melting of the top courses of the chequers and consequent short life. In old furnaces, with small chequer chambers, these fillings may have undoubted advantages in the balance; but with a furnace designed with reasonably-sized chambers, most of the work is being done by the top chequers, and the temperature of a large proportion of the chequers fluctuates very little over and under some very moderate temperature. The 2½-in. and 3-in. thick chequer brick stores a reserve of heat in its interior during the normal working that can be tapped at the week-end stoppage, when charging up a large quantity of cold materials, or when doing a minor repair. This prevents the undue cooling of the furnace and keeps the furnace gassing properly.

Trials have been made when using the usual 9 by 4½ by 3-in. or 2½-in. bricks with straight-through, half-staggered or fully-staggered chequers, and also chequers with smaller holes at the bottom than the top, but no setting has been wholly satisfactory.

Straight-through chequers with large holes allow high waste-gas temperatures; chequers with small or staggered holes choke up with dust. The straight-through chequer heats more evenly to a lower maximum temperature; the tight and staggered chequers have a tendency to cause high top temperatures which melt away the bricks.

The examination of a chequer chamber often—one might say, usually—reveals the fact that only part of the chequers are being used, and that the hot gases are short-circuiting or channelling through only part of the chequers. This is found consistently in chequers which are large in length and shallow in depth. Recently, trials have been made with a type of filling that has given very promising results, namely, 9 by 4½ by 3/2-in. side wedge bricks, set at 9 by 9-in. or 6 by 9-in. centres fully staggered, and in one case 6 by 9-in. centres straight through. This filling was tried in the hope of stopping this channelling of the waste gases and making use of the whole of the chequers. It has been tried on four furnaces, and is apparently successful in its operation. The wedge brick seems to split the gases without much resistance in the staggered chequer; it diverts it four ways down clear passes forming the corners of a prism and causes considerable turbulence (Fig. 1). The draft required is less than with ordinary staggered chequers, and the furnaces so equipped are working at a draft of 0.8 to 0.9 in. w.g. (Blaw Knox valves), and 1.1 in. w.g. with butterfly and water-sealed valves. The temperature of the top air chequers is 1,100 deg. to 1,200 deg. C., and that of the mixed waste gases 550 to 600 deg. C. The flame in the furnace is very good, and the outputs have improved since fitting these chequers. The leakage of air into the chequer chambers has been minimised considerably by

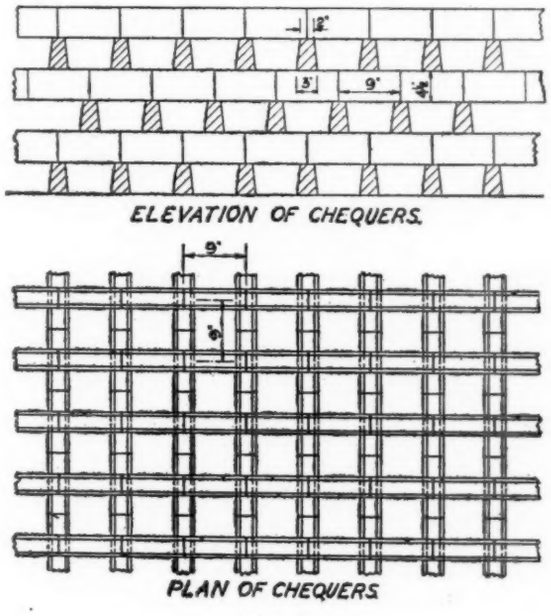


FIG. 1.

* Paper read at the Autumn Meeting of the Iron and Steel Institute.

careful pointing and the application of two or three coats of a cheap special tar preparation, which closes up the brick pores and cracks in the brickwork very well.

The insulation of the furnace structure seems an obvious way of conserving heat. A trial was made by insulating the ends of the roof of a furnace nearing the end of its campaign, and it was found impossible to prevent the roof from dripping inside and very rapidly melting away. The bottom of one furnace has been insulated with 2 in. of magnesia-asbestos brick underneath the magnesite brick and dolomite bottom. After this bottom had had over 37,000 tons of steel made upon it, it was thoroughly examined; some of the insulation was laid bare and was found to be in excellent condition. It has had a further 30,000 tons made on it up to date, and there is no trouble to report.

It was thought at first that the conservation of heat caused by the insulation might cause the bottom to wear away quickly, but after the first few weeks on a new rammed bottom careful inspection has shown this to be little, if any, different from the ordinary insulated bottom.

For quick working the furnace must have a regular and adequate supply of good gas, which can be burnt under the most favourable conditions. Any modern gas plant will fulfil the first part of these conditions. The Appleby plant has an installation of Kerpely producers with mechanical ash discharge, Chapman feed and agitator, a device of works design for keeping the height of the fuel bed constant, and a Synchroflo gas-pressure regulator which controls the steam supply to the separate turbo-blowers supplying the air and steam to the producers. The steel furnaces are supplied from a common gas main, and this results in a much more regular demand for gas than is possible with producers supplying separate furnaces.

The automatic control of the air-gas supply to the furnace is complicated by the dirty and tarry nature of the producer gas. Whilst it may be impossible to make a scientific instrument to suit these conditions, yet a device has been in operation at the works for about two years which does the job more satisfactorily than the furnace operator. This consists of a simple arrangement of a cam on the shaft of the butterfly valve on the air-fan intake, worked by a wire rope from the up-and-down motion of the gas-regulating valve. The shape of the cam (roughly part of a spiral) is such that the air is cut off rather more quickly than the gas, giving a very hot turbulent flame when required and a softer flame when the gas is eased. The gradual dirtying of the mains as the week progresses is compensated for by the gradual increase of pressure of the gas producers as required. This simple apparatus is working successfully and giving excellent results. The air screws have been disconnected on these furnaces for over 18 months, and the operator cannot vary the air proportion. The total fuel used with three furnaces working over the last three months is 3.14 cwts. per ton of ingots on the average, not including the heating-up of new furnaces.

The use of recording pyrometers to indicate the waste-gas and chequer temperatures, draft recorders and air-quantity meters keeps a check on the operator's work and shows any unevenness in the furnace operation. Any obstruction or leakage which is occurring in the furnace system can be detected by this means before it is too late to take steps to remedy the trouble.

Charging and Casting Facilities.

The lay-out of the shop and the facilities for dealing with the materials outside the furnace are obviously of the first importance, as is also the use of these facilities to the best advantage. The revolving type of charging machine has advantages over the in-and-out type. It can pick up material from the back of the shop, where it can be shunted or loaded without delaying the working of the plant. The charge can be spread more evenly over the hearth of the furnace by entering the door opening at an angle, and so fill up the space between the doors. Careless charging can cause much delay in melting, and by piling up the charge in heaps and too near the ports may cause serious damage to the furnace linings and roof by deflecting the flame on to them. The use of water-cooled arches is a good proposition on the grounds of protecting the brick arches from the damage done by charging, without counting the other advantages gained thereby.

The charge should be put into the furnace as quickly as possible, but the materials should not be piled so high in the furnace as to deflect the hot gases on to the roof, and the furnace should not be chilled unduly. In charging molten iron it is often an advantage to keep out a portion of the iron until the charge is almost melted, with the object of preventing excessive foaming and loss of slag.

Quality of Raw Materials and Mechanical Condition Thereof.

Obviously, the purer the raw materials the quicker can the charge be worked. Unfortunately, the materials obtainable are seldom of this type, and too much stress cannot be laid upon the standardisation of the materials used. Cold pig-iron can be carefully graded and a constant quality charged into the furnace, or, alternatively, the quality can be varied according to requirements. In any case, the composition of the charge should be known. Scrap can be graded also, and a constant proportion of light and heavy scrap charged, or the proportion varied to plan.

The uses of a mixer are too well known to require description, but its chief use is the supplying of an iron of standard composition when required. It is much better to have an iron of poor but regular composition than one that varies erratically from poor to excellent. The mixer of the Appleby Iron Company, Limited, is fed with local basic stone and oxides on a schedule depending upon the variation from a standard analysis of samples taken every four hours.

In the absence of a press to deal with light scrap, much can be done to improve its chargeability by cutting it into smaller pieces and packing it into boxes carefully. The scrap is thus less bulky, and can be charged into the furnace more quickly. The mixing of the scrap so that it offers an uneven surface to the flame gives speed in melting—very light plate or sheet scrap when charged flat is most difficult to melt on account of the smooth surface which is offered to the flame.

Process and Practice; Chemical Control.

It is important to charge on a hot bottom, and in this connection an insulated bottom, as already described, has advantages. The method of charging the furnace must vary with the local conditions, but in the basic process it is of the utmost importance to charge in such a way as to make a covering slag quickly, the lime coming up as the charge melts. Under these conditions, the lime or limestone used can be cut down considerably with good results as to the quickness of melting, and quality of the melt (low phosphorus, high carbon) and slag, and it is not then necessary to charge further large quantities of lime (and fluorspar) in order to hold up the carbon and take out the phosphorus after melting. The method of charging a large tilting furnace at the Appleby works is as follows:—

The slag is left on after the tap, and five boxes (about 3 tons) of burnt lime are charged, which are taken up by the slag very quickly. The oxides and further limestone are mixed and charged, five boxes of each at a time and the remainder of the limestone to finish. After fettling the banks, steel scrap and cold pig-iron are charged, and after attending to the linings and door jambs, the molten iron is charged with the exception of about 40 tons. This takes from 5 to 5½ hrs. from tapping. When the whole is melted into a puddle—after about 11 hrs. in all—the remaining 40 tons of molten iron are added and the charge comes to the boil very quickly thereafter. Slag is removed about 2 to 3 hrs. later. Suitable additions are made, and the charge is finished off.

The analysis of bath samples as the charge works down takes considerable time, and it has been found that the carbometer gives reasonably accurate and very quick results if checked up constantly with the analysis of duplicate samples. After slagging the furnace, two samples are taken from the same spoon, one for the carbometer and one for analysis by the laboratory. The carbometer, which is thus checked, is used for frequent samples until the carbon analysis is 0.05 per cent. higher than is required. Another set of samples is taken, two for the carbometer and one for the laboratory (the carbon being estimated by the combustion method), and if the analysis is suitable as to phosphorus, sulphur and manganese and the charge is working properly, the carbometer is used every 10 minutes until the furnace is tapped, the last sample being taken as the taphole is being cut out. The time taken for the carbometer determination is 2½ min. from the furnace until completed. The saving in time may easily be equal to another ladle of steel per week.

Staff.

The staffing of the furnaces is a matter that has not always received the attention it deserves. It takes far less time to train young men with a technical education to become melters; the result is much superior, and the cost is no more. The pay and prospects in a modern open-hearth shop are equal to anything offered in the engineering and electrical trades. The possibilities of better work are enormous, and the control and working of large modern furnaces making big outputs to rigid specifications makes the policy absolutely necessary. The mixing of this type of melter with the older men is wholly good, there having been no friction and a quickening of interest on the part of the older men in the structure of the furnace and the reasons underlying the instructions given to them.

The results obtained by the practice discussed in the Paper are given below:—

Average furnace life between repairs	39,000	tons of ingots.
Average make of ingots per week over 13 weeks, two 250-ton and one 300-ton furnace	6,371	
Best output for 4 weeks for 1 furnace	10,042	
Best output for 1 week for 1 furnace	2,610	
Coal consumed at gas producers (without heating up)	3.14	cwts. per ton of ingots.
Burnt dolomite used for fettling (running repairs)	0.45	
Total burnt dolomite used, including general repairs	0.50	

By following up some of the points in this Paper, considerable progress may yet be made at the Appleby plant in speeding-up the working of a steel furnace. By turning the steel furnace into a more reliable machine it is possible to produce not only more but better steel at a lower cost.

The author acknowledges his indebtedness to the United Steel Companies for permission to publish these particulars, and to his assistant, Mr. A. Jackson, for help given in trying out new ideas.

Enamelling of Cast Iron.—In "Emailwaren-Industrie," R. Aldinger discusses the relative adhesion of enamel coatings as determined by the addition of cobalt, nickel, phosphates and other substances to the enamelling compound, and the oxidation, etching or copper-coating of the surface of the iron. A. Kräutle deals with the effect of cast-iron analysis on the ability of the surface to take a durable enamel and gives suitable analyses with an appropriate coefficient of expansion and having a suitable surface. G. Krebs discusses how the content of C, Si, Mn and P in the iron affects the ability of the surface to take an enamel.

Foundry Selling Practice.

By Eric N. Simons.

In a recent article it was suggested that visiting cards for representatives should carry, neatly, on the back, a brief alphabetical list of the foundry products. In his provocative way, the Editor appended to this suggestion a footnote in which he repudiated the idea, declared it retrograde, and suggested that one should assume one's foundry is known well enough to make any such use of the visiting card unnecessary. This attitude is symptomatic of something that forms the subject of the present article, and that constitutes, in this writer's opinion, one of the most grievous weaknesses of present-day foundry selling.

That weakness is the too eager cherishing of an abstract and mysterious something known as "dignity," or, sometimes, as "prestige." Far be it from the writer's intention to suggest that either dignity or prestige is a bad thing. It is, and always will be, a very good thing, on one condition—that the price paid for it is not too great. One must get down to essentials if this matter is to be discussed fairly. First of all, the one object of a foundry run on business-like principles is to sell its output. If it does not do that, it does not matter how much dignity it maintains nor how much prestige it possesses; it will go down. Therefore, selling the output is the prime consideration.

False Dignity.

Now, when one suggests that too great a price can be paid for dignity, this does not mean—as the inexperienced in discussion always assume it means—that one wishes to see cheapjack methods of selling adopted. It may be possible to sell castings once by cheapjack, undignified methods; it is rarely possible to sell them twice. And a foundry must *go on* selling its output. What one means, then, is not the adoption of these foolish, get-rich-quick selling practices, but the abandonment of any attitude that does not promote or help to promote the continuous selling of the output. This matter of visiting cards is a case in point. A personal friend who earns his living by selling castings had the job of representing his firm in a district some distance from the foundry. He, too, believed in dignity. He, too, believed it was unnecessary to tell a buyer what his firm manufactured. And the result was that out of 100 calls made over a certain period, thirty per cent. or so obtained no interview; four per cent. led to nothing, because the buyer was under the impression the castings he made were brass, whereas they were iron; and in seven per cent. the buyer told him he had only given him an interview "on the off-chance" that he might be selling iron. Furthermore, in about fourteen per cent. of the interviews he obtained, he learned that his firm was unknown to the buyer.

Now, acting on pure theory, this salesman would have gone on sending in his blank card, because it was more "dignified." Instead, he had this neat little abbreviated list printed on the back, marked the subject he wished to discuss, and saw at once his percentage of interviews increased by fifteen, and his turnover jumping up proportionately. Furthermore, this advance was maintained, and in new parts of his territory. In other words, he sold more of his firm's output *continuously* than he had been selling hitherto. Surely one cannot call this a retrograde step! And it has been matched in too many other instances known to the writer—including his own experience—for him to regard it as a freak result.

But the detail is unimportant; it is the attitude that is wrong. This notion that a firm is too big to do this, that, or the other, in order to sell its products is at the root of a lot of vilely bad selling. One man, who is distinctly clever at selling castings weighing a ton, yet will not follow up an inquiry for a casting weighing a hundredweight. Yet it often happens that the casting with the smaller weight shows in the long run the greater profit. Similarly, salesmen known to me will not call on firms in order to sell those foundry products that do not represent a high first cost, however much in total turnover may be represented by such sales over a given period of time. When this attitude is found, it will be learned that it has been acquired because the firm itself, in nine instances out of ten, has got too big an opinion of itself, and has conveyed this to its representatives. And it is almost always a sign of decline. Sometimes, to be quite fair, it is the methods of remuneration that are wrong; but not always. Generally, the argument is: "It's beneath the dignity of a firm like X and Y to go round offering such and such."

Another defect due to "dignity" is that salesmen will not call on certain small firms in their districts, because they are "not big enough to be bothered with." Yet the collective account of a few dozen such small firms might not only tot up to a fair total in the course of a year, but might also provide steady bread and butter work for the foundry in times when the big orders are non-existent. Similarly, salesmen often object to carrying a little literature or a sample or two about with them—even though it can be conclusively proved that such action would definitely increase the chance of business—for the reason that they consider "the representatives of X and Y are not mere bag-carriers." This is all very well. No one wants the representatives of the foundry to look cheap or to peddle; but their job, when all is said and done, is to sell the output, and to sell it to the maximum. If it can be said, with whatever degree of truth, that an order of whatever size has been lost as a result of too rigid an attachment to ideas of dignity and prestige, then the maximum is not being sold, and there is something wrong inside the representative's mind.

Lost Accounts.

But let us not confine these remarks solely to salesmen. They apply as truly to production men and sales managers. Everybody knows the type of man who receives what may be a rather irritable complaint from a customer, and says: "Who do they think *they* are, writing to *us* like this?" simply because he knows his firm to be larger than that of the person writing. Is it likely that a man standing on his dignity thus is going to write the type of letter that will soothe the customer and keep his account? Have we not all seen business lost through an angry or unduly haughty reply to a letter of complaint not altogether unjustified?

Again, the salesman himself is sometimes treated in the same off-hand manner, simply because he is an "outside" man, one who does not know all the arcana of founding, does not meet Bill and Tom and Jim on the works every day. When he reports a customer's grievance, he gets his knuckles rapped. Who is he to report trouble? Let him go out and sell castings. That is his job, not the reporting of the grievances of customers. Messrs. X and Y cannot be bothered by trivial little complaints of this sort. Hence an exasperated salesman, a disillusioned customer, and a lost account.

Reverting to salesmen, another type of false dignity must be mentioned. There is every reason why salesmen should own or drive cars. They can get in more calls, they keep in better personal condition, they create a more favourable impression of the foundry. But if it so happens that a salesman's car breaks down, it is foolish for him to refrain from making calls on foot—as certain salesmen are known to do—simply because they think it will lower their dignity, or, as they prefer to put it, "the dignity of the firm," to be seen going about on foot. While they are not making calls, they are not selling, and they are, therefore, not doing their job. Too many times, also, one has heard the excuse: "I never call on Smith & Company. I can't get my car up their road; it would damage the springs." To get out and walk is, of course, beneath the salesman's dignity.

But one could multiply instances of false dignity, from the director who engages a salesman because he has a public school accent and looks dignified, though his selling powers may be nil, to the representative who will not stay at any hotel but the Ritz, because it would harm his firm. And once again it must be repeated that the burden of this article is not an attack on dignity or prestige as such, but on the dignity and prestige that are only maintained at the expense of sales.

Sales must come first.

In other words, the prime test, the inescapable test, of all attempts to maintain a certain attitude is: "Does it sell our output?" Because if it does not, if it can be proved that orders that might be obtained are not being obtained, then the dignity and the prestige are but a sham façade behind which hides a lot of jerry-building. This cannot be stated too emphatically. The Editor of this JOURNAL may, *in theory*, be perfectly correct when he says it is wrong to have a list of products on visiting cards. But when it can be proved against him that such a practice actually increases a salesman's interviews, and therefore his turnover, not once but innumerable times, then the writer feels fairly safe in saying that *in practice* he is hopelessly wrong, and clinging to a set of notions that no foundry can afford to cling to in these strenuous times.

The first thing a salesman has to do to-day is to learn that he must adapt himself and his methods to the circumstances, and the writer ventures to suggest that, if the Editor had the full-time job of selling certain types of castings to-day, he would sooner or later come to look at even his visiting cards to see if they would give him help.

Dignity is good. Prestige is good. Nobody wishes to substitute impudence for either. But sales must come first, and dignity that does not contribute to sales is worthless.

Catalogue Received.

Electric Furnaces.—A twelve-page brochure, received from Wild Barfield Electric Furnaces, Limited, and G.W.B. Electric Furnaces, Limited, Elecfurn Works, North Road, Holloway, London, N.7, describes box-type furnaces with "heavy hairpin" elements. It describes and illustrates a really workmanlike furnace capable of attaining 1,100 deg. C. The feature of the furnace is the construction of the elements, which are in drawn-rod form and are easily replaceable. The elements are inserted in sides, roof and hearth, and make actual contact with the refractory fabric of the furnace. The success of this new departure we are able to confirm, as we have noted its application in certain special-duty furnaces which have come before our notice. Great stress is laid upon facility of changing the elements in this type of furnace, and it is now stated that it has been reduced to a matter of 20 minutes all told, and the simplicity of changing a lamp-bulb. The brochure runs to twelve pages and is splendidly illustrated. It is just the type of pamphlet our readers should have by them, as the general tendency in nearly all foundries making small castings is to install heat-treatment furnaces in order to get the best properties out of their castings before dispatch to the customer.

XUM

Works of Markham & Company, Limited, Chesterfield.

Markham & Company, Limited, of Chesterfield, is the modern outcome of a business which was established in 1860 by William Oliver, who built a small works on a site which is now the centre of Chesterfield. Mr. Oliver built his first winding engine of any importance in 1869. This had a pair of 26-in. cylinders by 5-ft. stroke and carried a parallel drum 12 ft. dia. It was built for the Pilsley Colliery Company, and is still in daily operation. In 1870 Mr. Oliver purchased the land on which the present works stand; the whole works, however, were not removed to Broad Oaks until 1874, at which time employment was found for about 100 men.

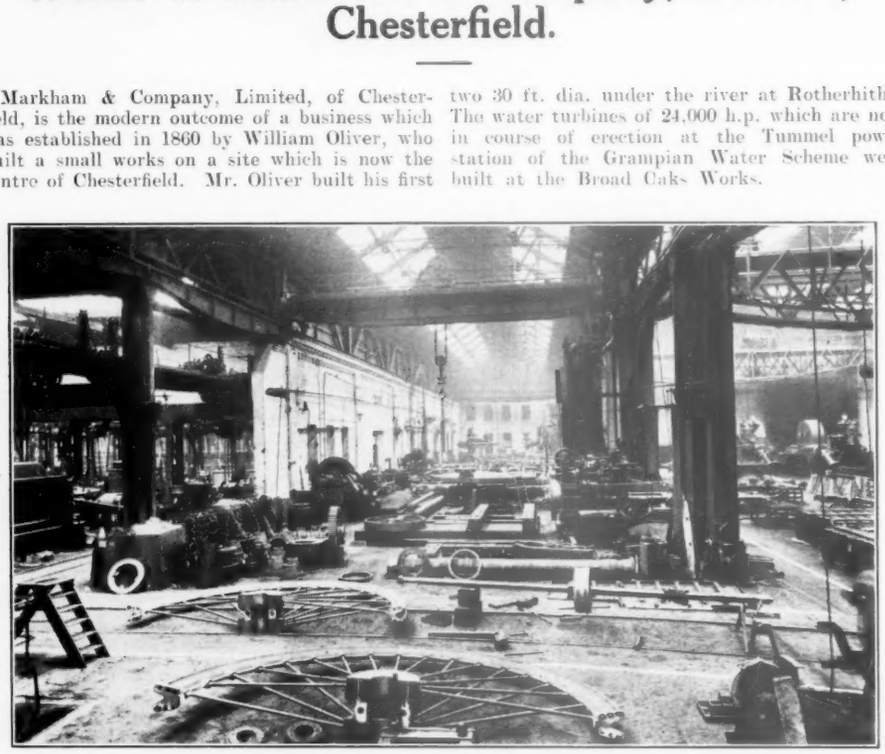


Fig. 1.—Showing Portion of Machine Shop at the Works of Markham & Company, Limited.

On October 1, 1889, the works were purchased by the late Mr. Charles P. Markham and controlled by him until his death in 1926. A master engineer and a man of remarkable foresight, well known and generally respected all over the colliery world, Mr. Markham soon built up a reputation for the products of the Broad Oaks Works, which were constantly increased in size, new buildings being erected almost annually. Fortunately the site available permitted such extensions being made without destroying the works continuity as a whole. The present works occupy an area of upwards of 26 acres and find employment for 850 men. Himself possessing extensive mining interests, it was natural that he developed largely in the production of mining machinery and plant.

Upwards of 150 large winding engines have been built, amongst them being the most powerful steam winders at work in Great Britain, which were built for Messrs. Pearson & Dorman, Long, Limited, and installed at Betteshanger Colliery. These engines have cylinders 36-in. by 84-in. stroke, and work at a steam pressure of 200 lbs. per sq. in. The conical drums rise from 16 ft. to 28 ft. Generally Mr. Markham favoured the simple engine; recently, however, the works built for the Daggafontein Mines, South Africa, a compound winding engine with cylinders 25 in. and 40 in. by 60 in.

A considerable amount of constructional work is also carried out for collieries, headgears in particular. Amongst others may be mentioned the Hickleton Main headgear, which is 95 ft. high and weighs 139 tons. The works have also an excellent record on general engineering account. Upwards of 50 tunnelling shields were built for the London Tube Railways, including two 30 ft. dia. under the river at Rotherhithe. The water turbines of 24,000 h.p. which are now in course of erection at the Tummel power station of the Grampian Water Scheme were built at the Broad Oaks Works.

The Foundry.

The pattern shop, which is a building 90 ft. long by 45 ft. wide, is airy and well lighted, and contains the usual complement of circular saws, band saws, planing machines, sanding machines, etc. The foundry is covered by two main bays each 400 ft. by 45 ft. and 35 ft. wide, devoted to the production of heavy and light castings respectively. The heavy bay is served by three 30-ton overhead cranes. The equipment includes two compressed-air jolt-ramming machines, the rams with 20-in. cylinders operating tables 6 ft. 6 in. with a lifting power of 8 tons. The air pressure is 90 lbs. per sq. in. Four jolt rams with 6-in. cylinders and two portable jolt rams are included. Castings up to 40 tons in weight are made in this foundry.

The sand shop adjoining the heavy bay contains the usual pan mixer and also a special mixer for oil sand; this has been found to give not only cleaner castings, but has led to increased production and at the same time placed much of the work within the scope of unskilled labour.

Machine and Erecting Shops.

The large machine shop is 300 ft. long by 46 ft. wide, and the floor is served by three electric cranes of 5, 20 and 30 tons respectively. The main machines comprise a Niles Tool Company vertical boring and turning mill, to take work up to 30 ft. dia. by 10 ft. deep; a Niles Tool Company universal boring machine with a range of 12 ft. longitudinally and 10 ft. in height; a boring machine which will take work up to 44 ft. dia.; a planing machine 30 ft. by 10 ft. by 10 ft. high which is used for large engine beds, cylinders, etc., and will plane either lengthways or crosswise without resetting. There are also a boring mill to take cylinders 110 in. dia. and shaft lathes to take shafts up to 3 ft. dia. by 30 ft. long. The equipment also includes Sunderland gear planers, Asquith drilling machines, etc.

The erecting shop is 210 ft. long by 70 ft. wide, the overhead runways carrying two 30-ton cranes. Amongst the work going through the shop at the time of our visit was a pair of winding engines for South Africa. The cylinders are 40 in. dia. and the stroke 72 in. The engines carry two drums each 14 in. dia. This set is for installation by the Randfontein Estates Gold Mining Company, Limited.

A small shop is laid off for the exclusive purpose of building small haulage engines, both compressed air and electric drives. These engines are really produced on mass-production lines in three standard sizes vertical and four standard sizes horizontal, ranging from 4½ in. by 5 in. to 6½ in. by 7 in. and 6½ in. by 9 in. to 10 in. by 14 in. respectively. The vertical electrically-driven engines are made in three sizes, 10, 15 and 25 h.p. All the engines are fitted with cut gears, piston valves, and sliding pinion. They are built on heavy lines to stand rough usage, are compact and all parts are easily accessible.

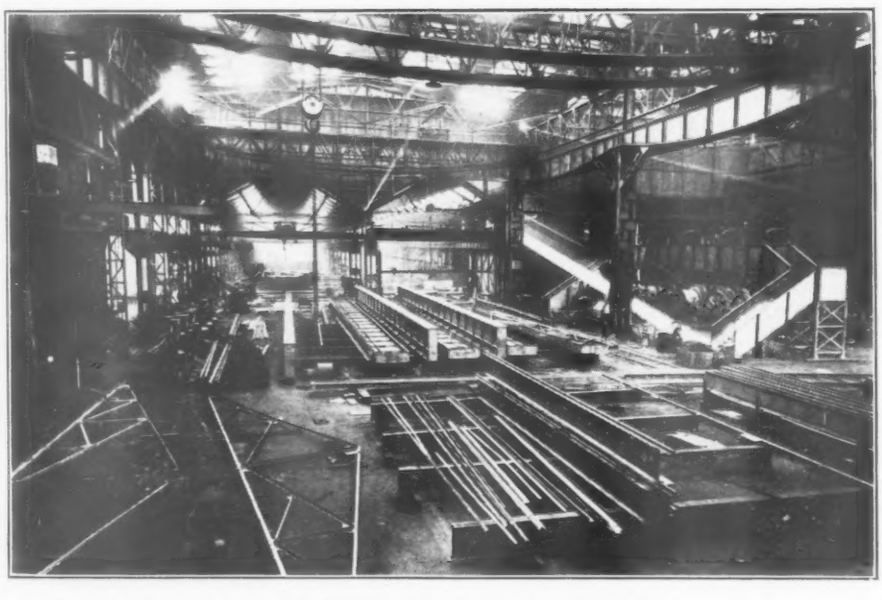


Fig. 2.—View in Erecting Shop at the Works of Markham & Company, Limited.

This range of engines was introduced by Mr. Markham several years ago, and has since found a ready market, the present output being 350 per annum.

(*Concluded on page* 179.)

Albion Works of Thos. W. Ward, Limited.

The Albion Works are not really works in the sense in which the word is usually applied. At the Albion Works are the central offices of this huge concern, which is associated with industry in general, and which probably has the finest assembly of reconditioned machinery in the world. In this extensive building are to be seen machines of every description and for nearly every trade, engineering, shipbuilding, iron and steel works, collieries, chemical works, etc., the normal stock catalogued, comprising over 10,000 lots, ranging from lathes to rolling mills, from steam engines to motors and generators. In the offices and their equipment there is much to be seen of sentimental interest. Thus, the board room is panelled with woodwork taken from dismantled ships. One sees the figure-head from one of our earliest men-of-war, or, again, the bell taken from the "Lucania"; there is, indeed, much to attract, much to interest the visitor. It is, however, when we come to consider the history and the development of Thos. W. Ward, Limited, that we reveal possibly the greatest romance of industrial Sheffield, and we have little doubt that a brief review of the building-up of the company's activities will prove of considerable interest.

View in Showroom of Reconditioned Plant at the Works of Thomas W. Ward, Limited.

It is exactly 55 years ago since the foundations of the business were laid by the late Mr. Thomas W. Ward; for it was in July, 1878, he then being 25 years of age, that he commenced business as a coal and coke merchant, occupying a small office in Norfolk Street, Sheffield. Shortly afterwards, his brother, Mr. Joseph Ward, joined him. Mr. Ward was essentially an opportunist, and he also speedily showed himself to be a man of shrewd business acumen, and, taking advantage of every opening, he speedily built up a business of considerable magnitude in coal, foundry, blast-furnace and blacksmiths' coke, ganister and steel scrap, and larger offices were taken in Wharf Street.

A subsidiary business was added, viz., the manufacture of horn and ivory handles for walking sticks and the like, and this is still carried on. A few years later another old Sheffield business, known as the Silent Machine Company, was acquired and reorganised, and is to-day one of the subsidiary companies of the firm. Mr. Ward's early experience in forge life was a great asset in the growth of the scrap-iron and steel department. A residue of such works was flue and tap cinder, then regarded as of little value, and it was mainly due to his persistence that they acquired their place of economic value in pig-iron manufacture.

With the establishment of the scrap department in 1881 came a new era. Mr. Ward soon built up a reputation for his firm. Towards the close of the first decade, dismantling of iron-works and colliery plant was commenced, together with the opening of export trade in re-usable scrap. It was at this time that the first portion of the present Albion Works was rented and the first reconditioning plant and showroom equipped. A 15-ton overhead electric crane was installed in this department in 1897, which is believed to be the first of this type erected in Sheffield.

The rail department had its inception in 1887, when some 2,000 tons of rails were purchased from the Government. The purchase of a large quantity of sectional steelwork at the completion of the Forth Bridge in 1890 brought into existence the constructional engineering department. In a similar manner the locomotive and contractors' material department had its origin in the purchase of locomotive and contractors' plant, after the opening of the Manchester Ship Canal.

The firm, for Mr. Joseph Ward had become a partner in 1889, whilst his brother Arthur entered into the partnership in 1894, was brought into touch with the ship-dismantling business when the "Great Eastern" was sold by auction. In 1904 the business was converted into a limited company, with a capital of £350,000. During this and the succeeding years a number of ship-dismantling works were established, notably at Morecambe, Briton Ferry, Swansea, Preston, Inverkeithing, Milford Haven, etc. The company were pioneers in the use of oxygen for the cutting up of scrap materials; and not only do they manufacture their own oxygen, but supply it for use of customers. In 1914 the capital of the company was increased to £450,000, and again in 1919 to £700,000, whilst a further increase in 1920 brought the capital of the company up to £1,100,000, which, by an increase of £250,000 made in 1923, made the tota up to £1,350,000.

The Longton Brickworks were purchased in 1918 for the manufacture of bricks and tiles. The old-established business of George Cooper & Sons, Effingham, nut and bolt works, purchased in 1925 and re-equipped with modern plant, is maintained in operation. In the same year the company acquired the Cornish De Lank granite quarries. In 1927 the company opened a blue-limestone quarry at Drybrook, Glos, and erected a crushing, screening and tarmacadam plant. They purchased the Albion (Mansfield) sand quarries and the Vale of Belvoir gypsum quarries, the manufacture of bricks being commenced a year later.

The North Lonsdale Tarmacadam, Limited, Ulverston, which has a productive capacity of 100,000 tons per annum, was purchased in 1928. These and other contemplated extensions called for additional capital, and in May, 1928, the capital of the company was increased to £1,850,000.

The company holds a controlling interest in the Ketton Portland Cement Company, Limited, and has the sole selling rights for the whole of the cement manufactured and freestone produced. The demand for the high-class cement manufactured at Ketton has entailed duplication of the plant, and when the new unit is set into motion next month, the output will be increased to 140,000 tons of "Ketco" and "Kettocrete" per annum.

Another interesting Sheffield concern from a manufacturing point of view is the old-established Laycock Engineering Company, which was acquired by Ward's three years ago. These works are splendidly equipped for the manufacture of all kinds of railway appliances, motor components and general engineering work. Amongst the specialities which have recently been developed are "Lodemor" industrial trucks, tram, 'bus and coach seatings, and the "Niagara" car washers and garage equipment. This company is also successfully manufacturing a range of American products which are now being made in this country because of tariffs.

The foundations of the business were not only laid and its expansion promoted by members of the Ward family, but Mr. Joseph Ward, J.P., who was Master Cutler last year and an original partner, is the present chairman and managing director. Mr. Ashley S. Ward is joint managing director, whilst Mr. A. J. Ward and Mr. W. A. Ward are assistant managing directors.

Works of Markham & Co., Ltd., Chesterfield.

(*Concluded from page* 178.)

The constructional department is covered by three lofty bays and served by a number of overhead cranes. The equipment includes bending and straightening rolls, plate-heating furnace, hydraulic and pneumatic riveters, radial drilling machines, etc. The smithy is 140 ft. by 35 ft. and is served by a 30-ton electric crane and equipped with 20 hearths, 4 steam-hammers and an 80-ton press. The works are electrically driven throughout, current being taken from the power plant of the Staveley Coal & Iron Company, Limited.

French Foundry Competition Prize Winners.

The Centre de Recherches de Fonderie des Hauts Fourneaux de Saulnes announces that it has awarded a prize of 2,000 francs to MM. Herry and Mettauer, of Nancy, for their essay on "The Use of Cast Iron as Tiles and other Details Used in the Roofing of Buildings," and a second prize of 1,000 francs to Mr. Simmorre, of Angoulême, for his Paper on "Pavings and Covered Metal Roads."

A similar competition is being organised this year (closing date, November 30), and a sum of 10,000 francs is available as prize money.

Scunthorpe Works of Thomas Firth & John Brown, Limited.

The Scunthorpe works were erected in 1918 to house the steel foundry plant which had up to that time been in operation at the Atlas Works of John Brown & Company, Limited, Sheffield. Since the establishment of the works under notice, the whole of the steel castings have been made at Scunthorpe. In 1931, subsequent to the amalgamation of John Brown & Company's steelworks with those of Thos. Firth & Sons, Limited, it was decided to extend the Scunthorpe works to accommodate part of the Firth foundry plant. It was felt advisable to retain and thus to centralise the production of steel castings, with the exception of that section dealing with stainless castings, which still remains at Sheffield.

The present plant, therefore, has a very wide range of production, including turbine casings for land and marine service, valve boxes and steam service castings for high-superheat and high-pressures, castings for hydraulic gear, Pilger rolls, 13 per cent. manganese steel castings, nickel-chrome steel for high-duty castings, etc. Castings are also made by the centrifugal process, and in addition they make a special "Adamant" brand of chrome-steel castings for pulverising and grinding machinery of all kinds.

FIG. 1.—VIEW IN FOUNDRY OF THOS. FIRTH & JOHN BROWN, LIMITED.

The main building, which houses the steel plant, moulding department, finishing department, heat-treatment department and machine shop, is comprised of four bays, one 750 ft. by 60 ft., one 600 ft. by 25 ft., one 600 ft. by 52 ft., and one 340 ft. by 48 ft. Lines of track completely encircle the works, and a track is also laid into the shop. The arrangement enables all raw materials to be unloaded immediately at the rear of the point of consumption, and thus handling, mechanical or otherwise, is reduced to a minimum.

Steel-Melting Plant.

The steel-melting plant consists of one 4½-ton Héroult electric furnace and three 2½-ton Robert acid side-blown converters, the latter being fed by three cupolas, which are tapped into a ladle for transference to the converters. In this ladle the iron is desulphurised and the slag removed before charging into the steel furnace, thus ensuring very low sulphur content. In addition there is a cupolette for melting the manganese. The cupolas are blown by Roots blowers, blast for the converters being supplied by reciprocating compressors. The laboratory controls the supply of scrap and all raw materials analyses. Works practice provides for an analysis of all deliveries in addition to the analyses which are taken of all heats.

The Foundry.

The foundry is equipped with eleven overhead cranes in capacities up to 25 tons. As the major portion of the foundry production is of a special nature, hand-moulding is generally practised. There are, however, a number of Macdonald & Herman jolt machines and gear-moulding machines by Whittaker & Buckley & Taylor. The floor is also served by a sand slinger.

There are five coke-fired drying stoves, the necessary air for combustion being supplied by a fan which delivers into a breeches, one branch of which supplies the blast for the fire and the other delivers through the chequer brickwork surrounding the fire, the air for circulation in the stoves. A rather unusual feature is the employment of portable recording pyrometers in connection with the stoves, their main purpose being that of night watchmen, as it were.

One end of the foundry is laid off for centrifugal casting. It is served by a jolt-ramming machine and an overhead telpher system for conveying the boxes from the moulding floor to the casting point. There are four spinning tables, special ladles being used in connection with these, as it has been found that the metal is kept hotter during the complete process of pouring by the use of ladles higher and of smaller diameter than standard. The ladles of metal are placed on a transfer bridge which spans the spinning-table enclosure. The ladles are bottom poured into an intermediate cup which feeds the mould. This cup is provided with a side overflow spout, and by keeping the level of the metal up to this spout, it is delivered to the mould at a constant head. Alloys are delivered by means of a compressed-air gun. It is thus possible to exercise the most accurate control over the whole of the operations. Practically the whole of the cores are hand-made and the two core-drying stoves are coal-fired.

Fettling and Machine Shops.

The fettling shop is equipped with a shot-blasting plant, oxy-acetylene cutting plants, and a full complement of pneumatic tools. The swinging and fixed grinders are all of the high-speed type. The sand plant comprises the usual runner mills with a plant by the Rapid Magnetting Machine Company, Limited, of Birmingham, for reconditioning the used sand. Boxes are stored in a yard beneath a gantry, which is spanned by a 5-ton crane. The stocking ground is also served by a Fordson locomotive.

The heat-treatment department is equipped with seven furnaces, of which six are coal and one oil-fired, there are the usual oil and water tanks. There is also a plant for annealing the manganese castings by water spray. Every manganese casting water-treated is subjected to the Brinell test before being passed to the finishing department.

The machine shop equipment includes lathes, planing machines, slotters, shapers, radial drilling and vertical drilling machines, turning and boring mills, and several types of sawing machines, whilst the testing plant comprises a Buckton 50-ton screw type tensile testing machine, hydraulic bend testing machine, Brinell and other hardness testing apparatus, together with the necessary machines for the preparation of the test-pieces.

With a view to economy and efficiency it was deemed advisable in January, 1931, that the whole of the steel-making and foundry interests of John Brown & Company, Limited, should be transferred to Thos. Firth & Sons, Limited. In order that the merged identities should not be lost sight of and to maintain the accumulated goodwill of the two concerns, the name of the company was changed to Thos. Firth & John Brown, Limited—with the dual address of Atlas & Norfolk Works.

Publications Received.

The Rise of Metallurgy, with Special Reference to Sheffield Discoveries, Inventions and Research.—Sir Robert Hadfield, Bt., F.R.S., has sent us a copy of his Address of Welcome to the members of the Iron and Steel Institute to the East Hecla Works of Messrs. Hadfield's, Limited. This is not, as one might imagine, of the mere proportions of an average speech such as one expects from Lord Mayors, Chancellors of Universities and similar dignitaries, but a beautifully presented booklet running to over one hundred pages. We were, naturally, attracted to what Sir Robert had to say about the proposed degree in foundry practice, and quote in full his remarks:—

> "In keeping with its progressive spirit, and in recognition of the ever-increasing importance of scientific methods in all branches of industry, the University of Sheffield has taken into favourable consideration the important suggestion put forward by our Professor of Metallurgy, Dr. J. H. Andrew, with regard to the establishment of a Founding Course in the Faculty of Metallurgy, with degrees in foundry science for those who qualify. It is hoped that before long Professor Andrew's ambition will be realised. A successful student would be known as a Bachelor, Master or Doctor in Metallurgy, the word 'Founding' being inserted in brackets after the degree."

As a native of Sheffield and an ex-student of its University, we found the book so fascinating that its perusal occupied more time than could reasonably be spared after our participation in the Prague Conference. To other old students we would suggest that they write to Sir Robert and assure for themselves a similar pleasure, if the edition has not yet been exhausted. They will find illustrated all their professors and many of their old colleagues, together with the local dignitaries they learned to admire in their youth. Sir Robert has done for them exactly what they would have wished to do for themselves. The illustrations are excellent and well chosen, whilst the letterpress shows considerable literary ability.

This Week's News in Brief.

Trade Talk.

THE ALEXANDRA TOWING COMPANY, LIMITED, Liverpool, have placed an order with Messrs. J. Crichton & Company, Limited, Saltney, Cheshire, for two single-screw steam tugs.

THE BLACKMAN EXPORT COMPANY, LIMITED, announce their removal on September 29 from 374, Euston Road, London, N.W.1, to more up-to-date offices at 23, Queen Square (Southampton Row), W.C.1.

THE NORTH DEVON INDUSTRIAL DEVELOPMENT COMMITTEE has appointed a representative sub-committee to inquire into the extent of the mineral resources in North Devon and the possibilities of taking steps for their development.

VALUABLE ORDERS for high-speed tool steel, for use in Russian engineering works, are reported to have been placed with Sheffield manufacturers by the Soviet Government. It is stipulated that shipments should be completed before the end of November.

ALL THE EMPLOYEES of the New Cransley Iron & Steel Company, Limited, proprietors of the Cransley (Northants) Furnaces, have been put on day-to-day notices, a temporary measure which is the prelude to the blowing-out shortly of the existing No. 2 furnace and the replacing of it by a larger one because of the brighter prospects in the industry.

THE STOBIE METALLURGICAL CONSTRUCTION COMPANY (Mr. Victor Stobie, M.I.E.E., P.P.I.B.F.), Soho Foundry, Meadow Road, Leeds, have designed and placed upon the market an electric jolt moulding machine. To the best of our knowledge, this is the first time in history that such a machine has been made available to the foundry world.

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED, has "blown in" a third blast furnace at Coniston, Ontario, bringing the smelter operations at that point up to about 65 per cent. capacity. The market for nickel, which has shown a steady increase since last autumn, is being well maintained and sales are keeping up to an encouraging degree. New uses for nickel are being developed by the company's research staff, and business is expected to keep pace with the revival of industry generally.

THE IMPORT DUTIES ADVISORY COMMITTEE give notice of an application for the addition to the free list of (i) nickel mass (consisting substantially of nickel hydroxide and graphite); (ii) cadmium mass (consisting substantially of finely-divided metallic cadmium and iron partially oxidised). Any representations which interested parties may desire to make should be addressed in writing to the Secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, London, S.W.1, not later than October 16, 1933.

MESSRS. LITHGOWS, LIMITED, Port Glasgow, have launched the cargo steamer "Harbury," which they have built to the order of Messrs. J. & C. Harrison, Limited, London. The "Harbury" is the seventh vessel built by Messrs. Lithgow for the same owners within 18 months, and three more vessels are in course of construction. The new vessel is 433 ft. in length and has a deadweight carrying capacity of 8,500 tons. The propelling machinery and boilers are being supplied by Messrs. David Rowan & Company, Limited, Glasgow.

THE FORDATH ENGINEERING COMPANY, LIMITED, Hamblet Works, West Bromwich, announce that a rumour has recently reached them from several sources to the effect that some members of their internal organisation have left them, to enter into business relations with a recently-started firm in the North, trading in core oils, etc. They desire to contradict this rumour, and to state that no man who has ever had any connection whatever with their manufacturing departments has left their works to join a competitive firm, since the Fordath Engineering Company commenced business.

MESSRS. FULLERTON, HODGART & BARCLAY, LIMITED, Vulcan Foundry, Paisley, have just shipped two winders for use in the gold mines in South Africa. They have also secured a contract for two more winders of the same type, and have on hand altogether six more machines, all for South Africa. Two of the winders are larger than usual, being 35 ft. in diameter and capable of winding from a depth of 6,000 ft. Messrs. Robert Maitland & Son, Limited, Gartlea Foundry, Airdrie (lately taken over by Mr. Robert Letham), have secured a contract for the supply of the iron castings for heavy winding machinery for gold mines in South Africa. The contract is the second of a similar nature booked by the firm within the past four weeks, and will keep the foundry busy for several months.

MESSRS. DAVID BROWN & SONS (HUDDERSFIELD), LIMITED, have just completed in a week the transfer of over 400 tons of machinery and equipment of the Keighley Gear Company from Keighley to Prospect Iron Works, Lockwood, near Huddersfield, a property recently acquired by Brown's. The Keighley company was taken over by Messrs. Brown shortly after the war, and in 1929 the works in the Airedale town were entirely reorganised. Business since then has increased to an extent demanding larger premises, and to meet this necessity the transfer to Lockwood has been achieved, and will, at the same time, owing to the much shorter distance, greatly facilitate co-operation between the main and subsidiary undertakings. Practically all the Keighley workers are transferred to Lockwood.

BEHIND THE LAUNCHING of the Diesel electric tug "Lectro" from the yard of Messrs. Henry Robb, Limited, Leith, on September 21, lies the story of an effort to obtain for Great Britain the lead in one of the most important developments that has taken place in ship construction in recent years. In view of the fact that Diesel-electric propulsion of ships had been for some time attracting attention abroad, an agreement to co-operate in the building of the tug was reached by the Union Lighterage Company, Limited, London, who ordered the vessel, British Thomson-Houston Company, Limited, for the electrical machinery, Messrs. Mirrlees, Bickerton & Day, Limited, Stockport, for the Diesel engines, and Messrs. Henry Robb, Limited, Leith, for the hull. Specially designed for service on the Thames, the "Lectro" is virtually a floating power station, and will be the most powerful tug of her size on the river. Two Diesel engines, each of 360 h.p., are employed to drive the main generators, which supply current to the propelling motor of 580 h.p. Two smaller generators provide current for the electric steering gear, lighting and auxiliary services. The control gear is claimed to be superior to any yet used and foolproof in operation. It is anticipated that trials of this type of vessel will reveal an economy in operating costs and an ease of control which will set a new standard in water transport. Mr. Edmeades, who represented the owners, speaking after the launch of the tug by the Marchioness of Linlithgow, said that his firm had decided to have another tug of the most modern design built at Leith.

Company Reports.

Coltness Iron Company, Limited.—Interim dividend of 3 per cent.

British Insulated Cables, Limited.—Interim dividend of 1s. per share, less tax, for the half-year ended June 30.

Neepsend Steel & Tool Corporation, Limited.—Profit, £18,785; final dividend of 5 per cent., less tax, making 7½ per cent., and additional dividend of 1½ per cent., less tax, on preference shares, making 7½ per cent.; carried forward, £11,172.

Qualcast, Limited.—Net profit, £19,876; brought in, £49,951; final dividend of 10 per cent. on the ordinary shares, making 15 per cent. for the year; written off goodwill, etc., £10,945; expenses of preference issue written off, £4,021; carried forward, £28,718.

British Aluminium Company, Limited.—Dividend at the rate of 6 per cent. per annum on the preference shares for the six months ended June 30, 1933. The directors have decided to await the full year's trading results before considering the payment of a dividend on the ordinary shares.

Steel Company of Scotland, Limited.—Net profit, £50,358; brought in, £162,366; to reserve, £30,000; to bad-debt reserve, £3,000; to tax reserve, £2,000; to loan discount account, £2,700; dividend for year of 2½ per cent., less tax; carried forward, £165,649. Directors propose to take £250,000 from general reserve and apply same to depreciation of land, buildings and plant, leaving £242,500 at credit of reserve.

Personal.

MR. ROBERT LANG, brassfounder, Calderside, Jerviston Street, was knocked down by a motor-car in Windmill Street, and seriously injured. He was removed to the Glasgow Royal Infirmary.

MR. D. CRAIG, who has been foundry foreman with Messrs. Shanks & Company, Limited, Barrhead, for 41 years, is retiring on September 30. Mr. Craig, who is 75 years of age, was formerly foreman in the foundry of Messrs. Cameron & Roberton, Kirkintilloch.

SIR SAMUEL ROBERTS, a director of Messrs. Newton, Chambers & Company, Limited, and chairman of Messrs. J. Grayson, Lowood & Company, Limited, has been elected Junior Warden of the Cutlers' Company. Sir Samuel is a former Lord Mayor of Sheffield and Member of Parliament for the Ecclesall Division.

MR. CHARLES J. WALSH, who recently was elected Master Cutler in succession to Lieut.-Colonel A. N. Lee, is one of the general managers of the United Steel Companies, Limited, of Sheffield. Mr. Walsh had wide experience among iron and steel firms in Birmingham, Sheffield and other centres before joining the United Steel Companies about a year ago.

MR. ANDREW WHYTE, a director of the Lancashire Steel Corporation, Limited, has been appointed general manager of Messrs. Pease & Partners, Limited, Darlington. SIR RICHARD PEASE has resigned his position as managing director of the company. The position of general manager is a new one; that of managing director will not be filled. Sir Richard will retain his seat on the board. Mr. Andrew Whyte has been closely associated in a number of industrial enterprises with Mr. J. Frater Taylor, the present chairman of Messrs. Pease & Partners, Limited.

MR. S. J. ASTBURY has been appointed secretary of the Institution of Petroleum Technologists, in succession to Commander Stokes-Rees, R.N. Mr. Astbury graduated at Cambridge in 1919, after taking the Natural Sciences Tripos. On leaving Cambridge he joined Messrs. N. Hingley & Sons, Limited, of Dudley, and there received an engineering training under Mr. C. E. Lloyd. He has been for some years closely associated with developments in fuels and furnace work. Mr. Astbury has been Secretary of the Staffordshire Iron and Steel Institute since 1928.

Contracts Open.

Burton-on-Trent, September 30.—30-ton weighbridge and alternatively a 24-ton weighbridge, each with a platform 20 ft. by 8 ft., for the Corporation. The Stores Manager, Bond End, Burton-upon-Trent.

Cairo, November 14.—Motor pumping sets, etc., for the Ministry of the Interior. The Department of Overseas Trade. (Reference G.Y. 12,912.)

Johannesburg, October 23.—15-ton electrically-driven crane, for the South African Railways and Harbours Administration. The Department of Overseas Trade. (Reference A.Y. 11,974.)

Johannesburg, October 23.—Pig-iron, for the South African Railways and Harbours Administration. The Department of Overseas Trade. (Reference G.Y. 12,954.)

Obituary.

THE DEATH OF Mr. Peter Rintoul occurred last week at Kilbryde Castle, Dunblane, which he had taken for the summer. Mr. Rintoul was a director of a large number of industrial and financial companies, and at the time of his death he was chairman of the Coltness Iron Company, Limited; Shanks and Co., Limited; and deputy-chairman of Stewarts and Lloyds, Limited. He was a member of the Glasgow Chamber of Commerce and a director of the Merchants' House, Glasgow.

MR. WILLIAM SERVICE, whose death was recently announced, was well known in Glasgow engineering circles and was a Past-President of the Glasgow and West of Scotland Association of Foreman Engineers and Draughtsmen. He was trained as an engineer at Messrs. Muir & Caldwell's, Glasgow. He became a marine engineer and sailed for 25 years as chief engineer in vessels going to India and the Far East. Later he held shore appointments, and for some years was manager of Messrs. Murray, McVinnie & Company, Limited.

XUM

Raw Material Markets.

The process of recovery in the iron and steel markets continues to make steady progress. Although the export trade is still far from what could be desired, prospects in the home markets are decidedly better. The pig-iron producers are in a strong position, and an expansion of output would not be unexpected. Steelworks engaged on the production of semis have plenty of work in hand, and the position at the finished steelworks is also improving, in spite of the continued lack of shipyard work.

Pig-Iron.

MIDDLESBROUGH.—Relative to the position some months ago, the foundry-iron makers in this area are now quite well situated. The current output is not sufficient to satisfy the demand, and heavy withdrawals are having to be made from stock. Hence it is confidently expected that one or more furnaces will shortly be added to the number in blast on Cleveland iron. Current sales apparently show no falling away. Messrs. Dorman, Long & Company, Limited, are shortly to blow in a furnace on basic iron. Home quotations are maintained, as follow:—No. 3 Cleveland G.M.B. 62s. 6d. per ton delivered Middlesbrough, 64s. 6d. per ton delivered North-East Coast, 62s. 3d. delivered Falkirk, 65s. 3d. delivered Glasgow. No. 1 grade of Cleveland iron commands a premium of 2s. 6d. and No. 4 forge and No. 4 foundry are at a discount of 1s. per ton on the above rates. Some export business is reported, the prices varying considerably as there is no control on overseas business.

The East Coast hematite market has a firm tone, owing to the heavy consumption in the local steelworks and to the strong demand from the Midlands and South Wales. The export demand is slightly better, another large cargo having been recently despatched to Italy. The home quotations are unchanged at 59s. for East Coast mixed numbers and 59s. 6d. for No. 1 quality. No price-fixing agreement has yet been arrived at, the chief obstacle being the heavy stocks of unsold material which are still outstanding.

LANCASHIRE.—The demand for pig-iron in Lancashire is still unsatisfactory when compared with other districts. Odd replacement contracts continue to come to hand, most users now being covered until the end of the year. The rate of delivery into consumption is slightly improved, but the heavy supplies of machinery scrap available continue to influence the situation. Offers of scrap range from about 35s. up to 42s. 6d. per ton, delivered to buyers' works. Pig-iron quotations are steady, with Derbyshire, Staffordshire and North-East Coast brands of No. 3 quoted for delivery to users in the Manchester zone on the basis of 67s. per ton, Northamptonshire at 65s. 6d., Derbyshire forge at 62s., East Coast hematite at about 74s., and West Coast hematite at between 80s. and 81s. Scottish foundry iron is offered for delivery in this area at about 80s. per ton, but Indian brands are obtainable at less than 70s., including delivery in the Manchester area.

MIDLANDS.—Generally speaking, the foundry-iron demand is fairly satisfactory in this area, and some of the furnaces are sending out more iron than they are making, having recourse to their stocks to make up the deficiency. With the exception of the heavy-castings section the consuming trades are fairly active at the moment, the light-castings makers being especially well occupied. There have been no alterations in prices. The minimum figure for Northants No. 3 is 62s. 6d. per ton and 66s. is quoted for Derbyshire, Lincolnshire and North Staffordshire No. 3, these figures including delivery to Birmingham and Black Country stations and being subject to a graduated rebate for big consumers. The makers of Cleveland pig-iron are not sellers at the old rates and are asking about 72s. 6d. per ton delivered this area for their No. 3 grade. Continental foundry iron is not competitive. With regard to special irons, low-phosphorus pig varies according to the producing district, quotations ranging from 70s. to 85s. Scottish No. 3 is at 85s. to 87s. 6d., and special refined irons for cylinder work are from £5 to £6 15s. per ton, according to quality and tonnage.

SCOTLAND.—New business in Scottish foundry iron is still limited. The official quotations remain at 65s. per ton for No. 3 foundry f.o.t. furnaces, with an extra of 2s. 6d. per ton for No. 1. There has been a rather better demand for Middlesbrough iron, consumers being more inclined to book ahead. Cleveland No. 3 is still obtainable at 62s. 3d. f.o.t. Falkirk area and 65s. 3d. delivered Glasgow area. There is a small call for other English irons at 1s. 3d. to 2s. 3d. per ton below these figures.

Coke.

The foundry-coke market is now attracting more interest, and users are entering into contracts for their winter supplies at the current rates, which for delivery in the Birmingham area are as follow:—Best Durham coke, 36s. to 38s.; other grades, 34s. to 35s.; Welsh coke, 30s. to 45s., according to analysis; Scottish low-ash coke, 39s. to 40s.

Steel.

Firm conditions rule in the steel markets, and the volume of business has been well maintained, according to the official report of the London Iron and Steel Exchange. In the semi-finished-steel section of the market the demand is active, and, although occasional transactions in Continental steel are heard of, the amount of business going to the Continent is not important. The British producers have well-filled order-books, and most of them are now asking higher prices than at the beginning of the month. Business in finished iron and steel appears to be increasing, and the demand from the home market in particular has been active. The improvement is also noticeable in the volume of inquiry overseas, but a considerable proportion of this fails to materialise into orders owing to the difficulties arising from exchange movements, import quotas, etc. Nevertheless, the outlook as regards export business appears to be promising.

Scrap.

There continues to be a good demand for cast-iron scrap in the Cleveland area, firmer quotations being reported. Midland ironfoundries remain busy, and there is a steady call for scrap material in that area. Heavy machinery metal is quoted at 47s. 6d., good pipe and plate scrap at 45s. and light metal at 40s. per ton, delivered works. In South Wales the demand for heavy cast iron and for machinery metal is rather quiet, but there is a fair call for light cast. The demand in Scotland is definitely better and prices are hardening.

Metals.

Copper.—The general trend of the copper market at the moment is not very encouraging. A certain amount of interest was shown by consumers last week, but speculative interests still hold back, and it seems that this position will continue until the American situation assumes a more definite form. In the meantime, the demand for copper manufactures fails to expand, and until it does so there is unlikely to be any recovery in prices. Slightly larger offerings of electrolytic have been made on the London market lately. The Copper Development Association has now been registered as a company. The formation of this body is a constructive step that should turn out to be of great benefit to the trade as a whole.

The week's prices have been as follow:—

Cash.—Thursday, £34 10s. to £34 11s. 3d.; Friday, £34 3s. 9d. to £34 5s.; Monday, £34 1s. 3d. to £34 3s. 9d.; Tuesday, £34 1s. 3d. to £34 3s. 9d.; Wednesday, £34 8s. 9d. to £34 10s.

Three Months.—Thursday, £34 12s. 6d. to £34 15s.; Friday, £34 7s. 6d. to £34 8s. 9d.; Monday, £34 5s. to £34 6s. 3d.; Tuesday, £34 5s. to £34 7s. 6d.; Wednesday, £34 12s. 6d. to £34 13s. 9d.

Tin.—Prices are showing little movement at the moment and buying activity has declined to a low level. Consumers are content to await a clearer outlook before entering into new commitments. Generally speaking, of course, the market remains in a fundamentally strong position as far as the control of supplies is concerned. As regards the recent selling of stocks held by the International Tin Pool, the brief statement issued following the meeting of the producers last week reveals that part of the metal was sold on the open market, while the rest was taken over by other holders. An increase in consumption would meet with a quick response in market prices.

Daily quotations:—

Cash.—Thursday, £215 15s. to £215 17s. 6d.; Friday, £214 15s. to £214 17s. 6d.; Monday, £215 15s. to £215 17s. 6d.; Tuesday, £215 10s. to £215 12s. 6d.; Wednesday, £216 12s. 6d. to £216 15s.

Three Months. — Thursday, £215 15s. to £215 17s. 6d.; Friday, £214 15s. to £214 17s. 6d.; Monday, £215 7s. 6d. to £215 10s.; Tuesday, £215 7s. 6d. to £215 10s.; Wednesday, £216 10s. to £216 12s. 6d.

Spelter.—The demand from consumers has been better during the past week and a fair tonnage has changed hands, report Messrs. Henry Gardner. Although turnovers on the London Exchange have been restricted, the market is very firm beneath the surface, and were outside conditions better, values would undoubtedly stand higher.

Price fluctuations:—

Ordinary. — Thursday, £16 15s.; Friday, £16 13s. 9d.; Monday, £16 12s. 6d.; Tuesday, £16 11s. 3d.; Wednesday, £16 13s. 9d.

Lead.—This metal has been steady, the market showing little change as compared with a week ago, report Messrs. Rudolf Wolff & Company. Offerings have on the whole been lighter and recent liquidation seemingly having for the time being spent itself, the undertone has been harder, with buyers showing an active interest at current prices. Consumption in this country is well maintained with a quiet, though regularly sustained, demand on the part of consumers. Conditions on the Continent, however, are not quite so good, though in this respect there should be some improvement in the near future. The price is low and the market meets with a good deal of resistance at current levels; some recovery therefore would no doubt take place were world consumption to give some indication of more definite expansion.

Daily market prices:—

Soft Foreign (Prompt):—Thursday, £11 18s. 9d.; Friday, £11 17s. 6d.; Monday, £11 18s. 9d.; Tuesday, £12; Wednesday, £11 17s. 6d.

Saline Drink for Hot Processes.—When men are employed on very hot work it is necessary to replace by water or a similar drink the body moisture lost as perspiration. This fact is well known. What is not universally realised is that the body not only loses water but a certain amount of natural salts. The absence of these salts causes the blood to thicken and so places more work on the heart. A saline drink is recommended by the Home Office and the following solution is suggested:—Sodium chloride, 6 ozs.; potassium chloride, 4 ozs.; water, 1¾ pints.

African Ore for Scotland.—The arrival of 8,000 tons of iron ore on the Clyde on Friday from Sierra Leone for Messrs. William Baird & Company, Limited, is the sequel to a development scheme of the Labour Government which in 1930 created the Colonial Development Fund to finance this and kindred plans to foster trade with the Colonies. The cargo is the first from Sierra Leone, and is of the same quality as the iron ore used to make Indian pig-iron. The Sierra Leone mines assure British manufacturers of abundant supplies, as they are capable of an output equal to Britain's normal demand. An important point is that the ore prices will enable Scottish and English firms to compete on more favourable terms with Indian material. Fully 8,500 natives were employed on the making of the harbour, railways and mine works. All the materials used were British and the enterprise has been planned and executed by British and Australian engineers and constructors. The company responsible for the project is jointly controlled by the Northern Mercantile Corporation, London, and Messrs. William Baird & Company, Limited, Scotland. Shipments from South Africa for Messrs. Baird will now replace those from Spain.

Mr. W. Routledge has been elected President of the Cleveland Institute of Engineers for the coming session. Mr. Routledge, who has completed 21 years' service as chief engineer of Messrs. Dorman, Long & Company, Limited, Cleveland Works (originally Messrs. Bolckow, Vaughan & Company, Limited), was trained at the works of Messrs. Markham & Company, Limited, Chesterfield, and the Westinghouse Company, Limited, Pittsburgh, U.S.A.

Which of these ten advantages would you most welcome?

—they are all incorporated in the Buell system of P.F. firing.

The Buell Combustion Co Ltd
49, MOORGATE, LONDON, E.C.2
Telephone: Metropolitan 7751 (4 lines).
Works: EDGAR ALLEN & CO., LTD., Imperial Steel Works, Sheffield.

10	Reduction in labour costs	10
9	Increase in furnace outputs	9
8	Ability to use lower and cheaper grades of coal.	8
7	Considerable reduction in metal losses due to scaling.	7
6	Elimination of stand-by losses when furnaces are shut down between turns.	6
5	Greater flexibility and more accurate control of flame conditions and corresponding reduction in furnace maintenance.	5
4	Elimination of laborious cleaning of fires as with hand firing.	4
3	Existing installations show lower fuel consumption between 18 and 49%.	3
2	Absolute reliance on standard number of heats.	2
1	At least 12% reduction in time required for furnace operation attained on *all* converted furnaces.	1

. . . universally recognised as the leading brand of Cylinder Pig Iron

WARNER CBR

The way to BETTER castings

WARNER & CO. LTD. CARGO FLEET MIDDLESBROUGH

RAW MATERIALS—PRICE LIST.

(Wednesday, September 27, 1933.)

COPPER.

	£	s.	d.
Standard cash	34	8	9
Three months	34	12	6
Electrolytic	37	15	0
Tough	36	5	0
Best selected	36	15	0
Sheets	64	0	0
India	45	15	0
Wire bars	38	5	0
Ingot bars	38	5	0
H.C. wire rods	40	0	0
Off. av. cash, August	36	2	$3\frac{3}{11}$
Do., 3 mths., August	36	6	$6\frac{3}{4}$
Do., Sttlmnt., August	36	2	$4\frac{7}{11}$
Do., Electro, August	40	12	$7\frac{5}{11}$
Do., B.S., August	39	10	$3\frac{1}{2}$
Do., wire bars, August	41	0	$8\frac{5}{11}$
Solid drawn tubes			$10\frac{1}{2}$d.
Brazed tubes			$10\frac{1}{2}$d.
Wire			7d.

BRASS.

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	$8\frac{1}{2}$d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	$7\frac{3}{4}$d.
Wire	$7\frac{3}{4}$d.
Rolled metal	$7\frac{1}{2}$d.
Yellow metal rods	$4\frac{3}{4}$d.
Do. 4 × 4 Squares	$5\frac{3}{4}$d.
Do. 4 × 3 Sheets	$5\frac{3}{4}$d.

TIN.

	£	s.	d.
Standard cash	216	12	6
Three months	216	10	0
English	217	0	0
Bars	218	10	0
Straits	223	5	0
Australian (nom.)	—		
Eastern	222	12	6
Banca	222	10	0
Off. av. cash, August	215	5	$10\frac{10}{11}$
Do., 3 mths., August	215	5	$4\frac{17}{22}$
Do., Sttlmt., August	215	5	$10\frac{10}{11}$

SPELTER.

	£	s.	d.
Ordinary	16	13	9
Remelted	16	0	0
Hard	14	0	0
Electro 99.9	18	15	0
English	17	2	6
India	16	0	0
Zinc dust	20	0	0
Zinc ashes	3	15	0
Off. aver., August	16	19	$0\frac{5}{22}$
Aver. spot, August	16	17	$4\frac{7}{11}$

LEAD.

	£	s.	d.
Soft foreign ppt.	11	17	6
Empire	12	5	0
English	13	5	0
Off. average, August	12	6	$4\frac{3}{11}$
Average spot, August	12	3	$7\frac{7}{11}$

ALUMINIUM.

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	25	15	0
Do., V.M. ex whse.	25	5	0
Rods	30	10	0

ANTIMONY.

	£	s.	d.	£	s.	d.
English	37	10	0	to 40	0	0
Chinese, ex-whse.				26	10	0
Crude				—		

QUICKSILVER.

	£	s.	d.	£	s.	d.
Quicksilver	9	0	0	to 9	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£6 10 0
45/50%	£12 10 0
75%	£18 2 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free of Mo.	5/6 per lb.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	2/– lb.
Tungsten metal powder—	
98/99%	2/3 lb.
Ferro-chrome—	
2/4% car.	£25 10 0
4/6% car.	£21 17 6
6/8% car.	£19 7 6
8/10% car.	£18 17 6
Ferro-chrome—	
Max. 2% car.	£29 15 0
Max. 1% car.	£30 17 6
Max. 0.70% car.	£35 15 0
70% carbon-free	10d. lb.
Nickel—99.5/100%	£225 to £230
"F" nickel shot	£202 10 0
Ferro-cobalt, 98/99%	5/6 lb.
Metallic chromium—	
96/98%	2/8 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to $\frac{1}{16}$ in.	1/– lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ¼ in. × ¼ in.	1/– lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.	£	s.	d.
South Wales—						
Heavy steel	2	8	0	to 2	10	0
Bundled steel and shrngs.	1	17	6	to 2	9	0
Mixed iron and steel	2	5	0	to 2	6	6
Heavy cast iron	2	5	0	to 2	6	0
Good machinery	2	6	0	to 2	7	6
Cleveland—						
Heavy steel				2	6	0
Steel turnings				1	11	6
Cast-iron borings				1	2	0
Heavy forge				2	10	0
W.I. piling scrap				2	0	0
Cast-iron scrap	2	2	6	to 2	5	0
Midlands—						
Light cast-iron scrap				2	0	0
Heavy wrought iron				2	10	0
Steel turnings, f.o.r.				1	6	0
Scotland—						
Heavy steel				2	5	0
Ordinary cast iron				2	7	6
Engineers' turnings				1	13	6
Cast-iron borings	1	13	6	to 1	15	0
Wrought-iron piling				2	6	3
Heavy machinery	2	10	0	to 2	12	6

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	29	0	0
Brass	19	10	0
Lead (less usual draft)	10	15	0
Tea lead	8	5	0
Zinc	10	10	0
New aluminium cuttings	72	0	0
Braziery copper	26	0	0
Gunmetal	26	0	0
Hollow pewter	135	0	0
Shaped black pewter	100	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	65/–
Foundry No. 3	62/6
„ at Falkirk	62/3
„ at Glasgow	65/3
Foundry No. 4	61/6
Forge No. 4	61/6
Hematite No. 1, f.o.t.	59/6
Hematite M/Nos., f.o.t.	59/–
N.W. Coast—	
Hem. M/Nos. d/d Glas.	68/6
„ d/d Birm.	84/6
Malleable iron d/d Birm.	115/–
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	62/–
„ No. 3 fdry.	66/–
Northants forge	58/6
„ fdry. No. 3	62/6
„ fdry. No. 1	65/6
Derbyshire forge	62/–
„ fdry. No. 3	66/–
„ fdry. No. 1	69/–
Scotland—	
Foundry No. 1	67/6
„ No. 3	65/–
Hem. M/Nos. d/d	66/–
Sheffield (d/d district)—	
Derby forge	59/6
„ fdry. No. 3	63/6
Lincs forge	59/6
„ fdry. No. 3	63/6
E.C. hematite	73/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	67/–
Staffs fdry. No. 3	67/–
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/–
Dalzell, No. 3 (special)	102/6 to 105/–
Glengarnock, No. 3	80/–
Clyde, No. 3	80/–
Monkland, No. 3	80/–
Summerlee, No. 3	80/–
Eglinton, No. 3	80/–
Gartsherrie, No. 3	80/–
Shotts, No. 3	80/–

FINISHED IRON AND STEEL.

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)	9	0	0	to 9	15	0
Nut and bolt iron	6	15	0	to 7	10	0
Hoops	10	10	0	to 12	0	0
Marked bars (Staffs) f.o.t.				12	0	0
Gas strip	10	10	0	to 12	0	0
Bolts and nuts, ¾ in. × 4 in.				13	5	0
Steel—						
Plates, ship, etc.	8	15	0	to 8	17	6
Boiler plts.				8	5	0
Chequer plts.				10	7	6
Angles				8	7	6
Tees				9	7	6
Joists				8	15	0
Rounds and squares, 3 in. to 5½ in.				9	7	6
Rounds under 3 in. to ⅜ in. (Untested)	6	17	6	& up.		
Flats—8 in. wide and over				8	12	6
„ under 8 in. and over 5 in.				8	17	6
Rails, heavy	8	5	0	to 8	10	0
Fishplates				12	0	0
Hoops (Staffs)	9	10	0	& up.		
Black sheets, 24g. (4-t. lots)				10	5	0
Galv. cor. shts. („)				12	15	0
Galv. flat shts. („)				13	5	0
Galv. fencing wire, 8g. plain				14	0	0
Billets, soft	5	5	0	to 5	12	6
Billets, hard	6	12	6	to 7	2	6
Sheet bars	4	15	0	to 5	7	6
Tin bars				4	15	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	11d.
Sheet to 10 w.g.	12d.
Wire	$12\frac{1}{2}$d.
Rods	11d.
Tubes	$15\frac{1}{2}$d.
Castings	13d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.

C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.

Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	18.34
No. 2 foundry, Valley	17.50
No. 2 foundry, Birm.	13.50
Basic	18.89
Bessemer	19.89
Malleable	19.39
Grey forge	19.39
Ferro-mang. 80%, seaboard	82.00
O.-h. rails, h'y, at mill	40.00
Billets	26.00
Sheet bars	26.00
Wire rods	35.00
	Cents.
Iron bars, Phila.	1.86
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.60
Steel hoops	1.80
Sheets, black, No. 24	2.25
Sheets, galv., No. 24	2.85
Wire nails	2.10
Plain wire	2.10
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$4.65

COKE (at ovens).

Welsh foundry	20/– to 22/6
„ furnace	14/6 to 16/–
Durham foundry	21/– to 25/–
„ furnace	14/3
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	16/9	to 17/–
„	28×20 „	33/6	to 34/–
„	20×10 „	23/10	to 24/4
„	18¾×14 „	17/4½	to 17/9
C.W.	20×14 „	15/6	to 16/–
„	28×20 „		32/3
„	20×10 „		22/9
„	18¾×14 „		16/6

SWEDISH CHARCOAL IRON & STEEL.

	£	s.	d.	£	s.	d.
Pig-iron	£6	0	0	to £7	0	0
Bars-hammered, basis	£16	0	0	to £16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to £16	0	0
Blooms	£10	0	0	to £12	0	0
Keg steel	£30	0	0	to £31	0	0
Faggot steel	£18	0	0	to £23	0	0
Bars and rods dead soft, st'l	£10	0	0	to £12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
Sept.	21 ..	34	10	0	dec. 1/3
,,	22 ..	34	3	9	,, 6/3
,,	25 ..	34	1	3	,, 2/6
,,	26 ..	34	1	3	No change
,,	27 ..	34	8	9	inc. 7/6

Electrolytic Copper.

		£	s.	d.	
Sept.	21 ..	37	15	0	inc. 10/-
,,	22 ..	37	0	0	dec. 15/-
,,	25 ..	37	5	0	inc. 5/-
,,	26 ..	37	5	0	No change
,,	27 ..	37	15	0	inc. 10/-

Standard Tin (cash).

		£	s.	d.	
Sept.	21 ..	215	15	0	dec. 15/-
,,	22 ..	214	15	0	,, 20/-
,,	25 ..	215	15	0	inc. 20/-
,,	26 ..	215	10	0	dec. 5/-
,,	27 ..	216	12	6	inc. 22/6

Tin (English ingots).

		£	s.	d.	
Sept.	21 ..	216	5	0	dec. 15/-
,,	22 ..	215	5	0	,, 20/-
,,	25 ..	216	5	0	inc. 20/-
,,	26 ..	216	0	0	dec. 5/-
,,	27 ..	217	0	0	inc. 20/-

Spelter (ordinary).

		£	s.	d.	
Sept.	21 ..	16	15	0	dec. 1/3
,,	22 ..	16	13	9	,, 1/3
,,	25 ..	16	12	6	,, 1/3
,,	26 ..	16	11	3	,, 1/3
,,	27 ..	16	13	9	inc. 2/6

Spelter (Electro, 99.9 per cent.).

		£	s.	d.	
Sept.	21 ..	19	2	6	dec. 2/6
,,	22 ..	19	2	6	No change
,,	25 ..	19	0	0	dec. 2/6
,,	26 ..	18	15	0	,, 5/-
,,	27 ..	18	15	0	No change

Zinc Sheets (English).

		£	s.	d.	
Sept.	21 ..	25	15	0	No change
,,	22 ..	25	15	0	,, ,,
,,	25 ..	25	15	0	,, ,,
,,	26 ..	25	15	0	,, ,,
,,	27 ..	25	15	0	,, ,,

Lead (English).

		£	s.	d.	
Sept.	21 ..	13	5	0	No change
,,	22 ..	13	5	0	,, ,,
,,	25 ..	13	5	0	,, ,,
,,	26 ..	13	5	0	,, ,,
,,	27 ..	13	5	0	,, ,,

AVERAGE MONTHLY PRICES OF IRON HOOPS.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1897	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 8
1898	6 10 0	6 10 0	6 10	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	7 0 0	6 11 6
1899	7 0 0	7 0 0	7 0 0	7 0 0	7 12 6	10 12 6	8 12 6	8 12 6	8 12 6	9 2 6	9 7 6	9 17 6	8 2 9
1900	9 17 6	10 7 6	10 7 6	10 7 0	10 12 6	7 12 6	10 12 6	10 12 6	10 12 6	9 17 6	9 2 6	9 2 6	10 3 8
1901	9 2 6	8 2 6	8 2 6	7 12 6	7 12 6	7 12 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 11 2
1902	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6
1903	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 0
1904	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6
1905	6 17 6	7 0 0	7 0 0	7 0 6	7 0 0	7 0 0	7 2 6	7 2 6	7 2 6	7 7 6	7 0 0	7 7 6	7 2 0½
1906	7 10 0	7 17 6	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	8 7 6	7 15 1½
1907	8 7 6	8 7 6	8 7 6	8 7 0	8 7 6	8 7 6	8 10 0	8 10 0	8 10 0	8 5 0	8 5 0	8 0 0	8 7 1
1908	8 0 0	7 10 0	7 10 0	7 10 6	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 6 8
1909	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0
1910	7 1 10½	7 6 3	7 7 6	7 7 0	7 7 6	7 7 6	7 7 6	7 7 6	7 7 6	7 6 3	7 5 0	7 5 0	7 6 5
1911	7 5 0	7 5 0	7 5 0	7 5 6	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 8 9	7 10 0	7 10 0	7 6 2½
1912	7 12 6	7 12 6	7 12 6	7 15 0	7 15 0	8 2 6	8 2 6	8 2 6	8 12 6	8 12 6	8 12 6	8 15 0	8 2 3½
1913	8 17 6	8 17 6	8 17 6	8 17 0	8 17 6	8 17 6	8 17 6	8 17 6	8 7 6	8 7 6	8 7 6	7 17 6	8 12 6
1914	7 17 6	7 17 6	7 17 6	7 13 9	7 12 6	7 12 6	7 12 6	9 2 6	9 2 6	9 2 6	9 2 6	9 2 6	8 6 4½
1915	9 3 6	9 18 1	10 7 6	10 16 6	10 17 6	13 2 6	13 2 6	13 2 6	13 7 6	14 2 6	15 2 6	15 18 6	12 10 1
1916	17 2 6	17 2 6	17 2 6	17 6 3	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 6 1
1917	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6
1918	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6
1919	17 2 6	17 2 6	17 2 6	17 2 6	24 6 3	24 6 3	24 6 3	25 9 0	26 7 6	26 7 6	26 7 6	26 17 4	22 14 9
1920	28 0 0	28 12 6	33 15 0	35 5 0	35 15 10	38 17 6	38 17 6	38 17 6	38 17 6	38 17 6	38 17 6	36 17 6	35 14 9
1921	29 1 3	23 5 0	21 12 6	20 0 0	20 0 0	20 0 0	17 5 0	15 0 0	14 4 0	13 15 0	13 10 0	12 18 0	17 5 10
1922	16 5 0	15 13 9	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	13 4 6½
1923	14 0 0	15 0 0	15 0 0	15 0 0	15 6 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	14 16 0	14 15 0	14 18 3½
1924	14 15 0	14 15 0	14 15 0	14 15 0	14 15 0	14 13 9	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 12 4½
1925	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0
1926	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0
1927	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	12 10 0	12 10 0	14 3 4
1928	12 10 0	12 7 6	12 0 0	11 13 6	11 15 0	11 12 6	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 14 10½
1929	11 10 0	11 10 0	11 10 0	11 10 0	11 9 0	11 5 0	11 5 0	11 5 0	11 5 0	11 2 0	11 0 0	11 0 0	11 5 11
1930	11 0 0	11 0 0	11 0 0	10 16 3	10 15 0	10 15 0	10 15 0	10 15 0	10 15 0	10 15 0	10 15 0	10 15 0	10 16 4½
1931	10 15 0	10 15 0	10 15 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 11 3
1932	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10- 0
1933	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

BRASS Foundry Foreman seeks engagement; last situation 14 years; considerable experience in Government contracts; phosphor-bronze and manganese castings.—Box 496, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

YOUNG LADY (28), Graduate of Leeds (French and German), seeks post as Foreign Correspondent. Slight knowledge Russian and Spanish. Five years' experience in Steel Works Office. Salary £175, or nearest, with prospects.—Box 510, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY Foreman for firm in Midlands producing 40 tons per week light grey-iron engineering, electrical and miscellaneous castings from machines, plates and wood patterns.—Apply Box 512, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

REQUIRED for N.E. Coast, Salesman at present handling foundry sands to carry additional lines of foundry requisites, by first-class manufacturers. Applications to state lines at present carried and present agencies.—Box 514, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

ENGINEER'S GUIDE TO SUCCESS (144 pages FREE), for well-paid posts and professional qualifications such as A.M.Inst.C.E., A.M.I.Mech.E., A.M.I.E.E., etc. Contains world's widest selection of home study courses in engineering.—Write, stating branch, post or qualification that interests you, to THE TECHNOLOGICAL INSTITUTE, 151, Temple Bar House, London, E.C.4. Hundreds of posts notified to T.I.G.B. students every year.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

FOUNDRY Foreman desires re-engagement. Has had experience in similar capacity with well-known firms on light and heavy castings up to 20 tons, general engineering, cupola practice and machine moulding. Good metallurgical experience. (225)

FOREMAN Patternmaker requires position. Experience includes marine turbines, propellers, pumps, mass-production methods and general jobbing. Good technical training. (226)

POSITION required as Foundry Manager or Foreman. Wide experience in Diesel, turbine, marine engines, pumps, hydraulic, machine tools, chemical plant. Modern cupola methods. Excellent testimonials. (227)

POSITION required as Foreman, Assistant Foreman or Assistant to Foundry Manager by young Moulder with sound practical experience, including ferrous and non-ferrous founding. Secondary-school education. Good technical qualifications. Willing to go abroad. (228)

MACHINERY.

FOUNDRY Transverse Bar-Testing Machine by Avery, for 2-in. x 1-in. Bars, 1 to 3 ft. long, calibrated up to 40 cwts., with deflection scale; in good working order. Price £30 or nearest offer.—HARTLEY, SONS & COMPANY, Engineers, Etruria.

FOR SALE IN GOOD CONDITION :—

Two Power Jar Ram Rollover Pattern Draw Moulding Machines, each 3 tons capacity.
Two Ditto, each 30 cwts. capacity.
Three Tabor Jar Ram Rollover Pattern Draw Moulding Machines, each 6 cwts. capacity.
One Tabor Split Pattern Moulding Machine.
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